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A focus on homes, not power plants, could halve energy bills

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Acknowledgements

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Key Findings

Focusing on household solutions such as thermal upgrades, efficient electric appliances, solar, batteries and load-shifting would be an effective strategy to halve residential energy bills.

Household energy upgrades benefit the broader energy system by mitigating gas supply gaps, managing peak electricity demand, and reducing greenhouse gas emissions.

A combination of improved minimum standards for household appliances and more comprehensive incentive schemes would be an effective way to accelerate uptake of household energy upgrades.

Retail pricing structures and network regulations need to be reviewed to ensure consumers can access the full value of household energy upgrades.

Executive summary

The rapid rise of abundant low-cost solar is driving Australian wholesale electricity costs to record low levels in the middle of the day. However, Australian households continue to see rising energy bills, due to factors including increasing coal and gas prices, outages at ageing power stations and network cost rises.

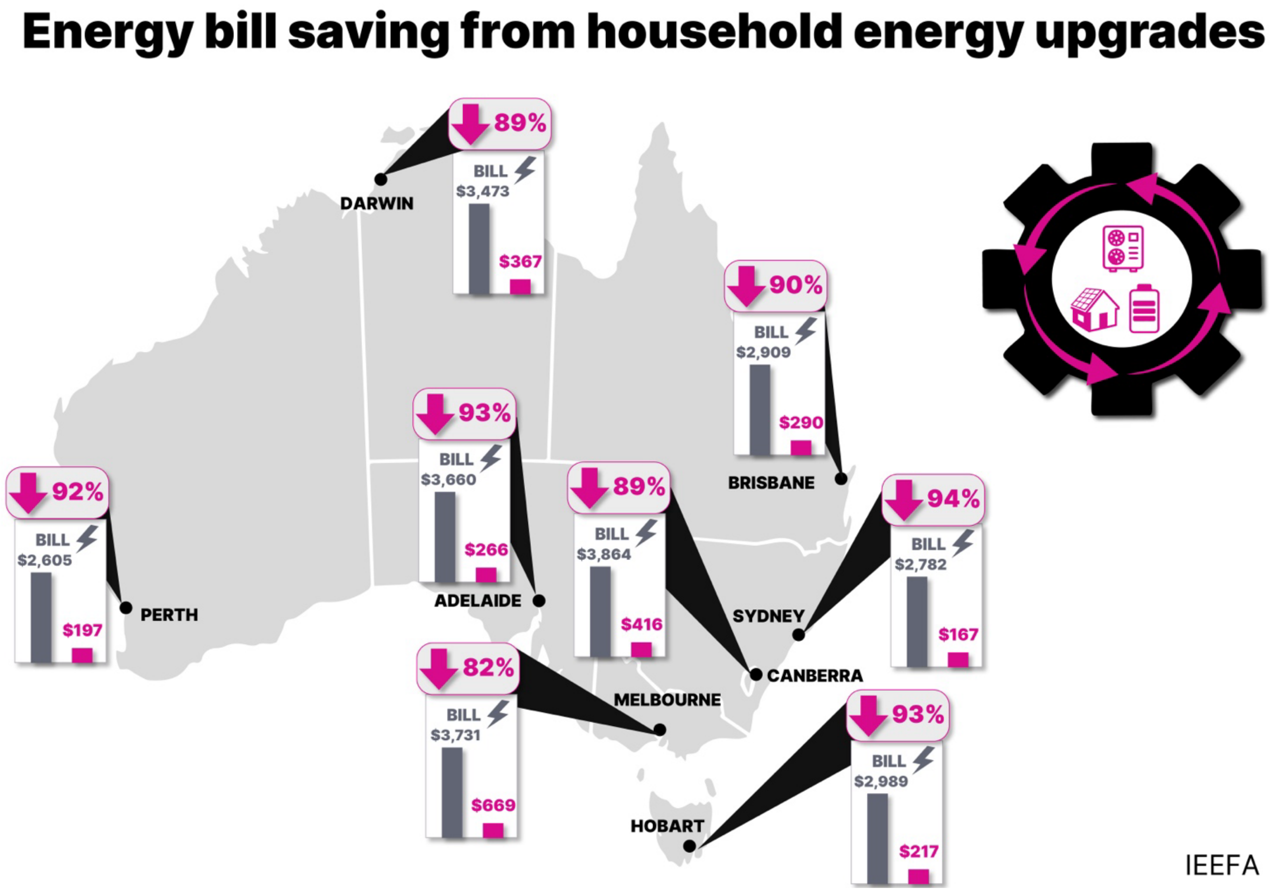
The policy debate on how to address rising energy costs has largely focused on the wrong solutions. This includes one-off power bill subsidies, and deliberation over whether to slow down the rollout of large-scale renewables in favour of alternatives (which more often than not would actually increase power prices).

These debates ignore the fact that energy bills are a product of not only the price of energy, but the amount of energy we consume. And reducing the energy that households consume from the grid (and using it more smartly) is one of the most effective ways to reduce energy costs.

Households that burn gas in their homes are wasting significant amounts of energy to meet their basic needs, as are those in poor thermally-performing homes, and those who rely on inefficient electric appliances.

Furthermore, while many Australian households now have rooftop solar, this can't be put to its full potential when energy demand is concentrated in the evening, or met by burning gas.

This report presents the results of new IEEFA modelling, which finds that household energy upgrades including efficient electric appliances, rooftop solar and batteries could slash household energy bills by more than 90% in many regions.



These savings are based on a typical, representative household in each capital city. While each household's situation and energy consumption patterns are different, the findings show that deep energy bill reductions can be enabled through household energy upgrades. These upgrades could form the core of a strategy to halve household energy bills.

Household energy upgrades also benefit other energy users, by cutting gas demand in constrained periods, and reducing peak electricity demand on the grid. This can result in lower generation costs and, in theory, lower network costs.

As an additional benefit, household energy upgrades offer a particularly low-cost form of emissions abatement. The upgrades modelled in this report would not only see overall energy consumption fall, but would shift electricity consumption to periods where solar is abundant, and the emissions intensity of electricity production is lowest.

In some regions such as Victoria, a poorly managed transition from gas to efficient electric appliances could result in a long-term increase in winter electricity demand. While shifting households off gas is highly beneficial in reducing expected gas supply gaps and greenhouse gas emissions, it also creates a need to consider how to manage peak demand in winter. Batteries, thermal shell upgrades and pre-heating are effective options to manage this.

Many household energy upgrades are highly cost-effective for households today – particularly where they are supported by federal or state rebates.

While residential batteries have longer payback periods than other upgrades, a combination of new federal rebates and expected future cost reductions will make them increasingly attractive. They will become even more cost-effective if their contributions to the grid during peak times are fairly valued.

Utilising the battery capacity in electric vehicles is a particularly significant untapped opportunity, if vehicle-to-home and vehicle-to-grid capabilities are unlocked via the right standards and regulations.

Homes with thermally efficient building shells offer the lowest running costs and the greatest opportunities to reduce peak demand. This includes through pre-heating and pre-cooling their home, which delivers some of the benefits of a battery at a fraction of the cost.

Despite the financial attractiveness of household energy upgrades, many households including renters or those on low incomes have no ability to undertake upgrades. Furthermore, even consumers who can invest in household energy upgrades are subject to “bounded rationality” – a barrier that is often overlooked by energy efficiency policies.

Increasing minimum energy performance standards to encourage a shift from gas or inefficient electric appliances to efficient electric alternatives is a compelling solution. New legislation to phase out gas hot water systems in Victoria presents one example of an approach to achieve this, and there is an opportunity to reinvigorate the federal Equipment Energy Efficiency programme.

In the near term, financial incentives play a critical role to reduce the upfront cost hurdle for consumers and scale up the industry capacity to deliver upgrades. However, the current approach to incentives is piecemeal.

Victoria and New South Wales have implemented broad-based incentives for household energy upgrades, but there is a case for more comprehensive national versions of these schemes to be rolled out, which could be complemented with specific state government schemes where they would bring further benefits.

Pricing reform is not the sole solution, but it is nonetheless critical to ensure consumers have access to fair electricity plans that reward their contributions to the grid, without imposing unrealistic expectations on consumers to become energy traders.

Finally, household energy upgrades will have material consequences for gas and electricity distribution networks – potentially reducing the overall reliance on both networks, while presenting opportunities to use electricity distribution networks more efficiently.

This offers an opportunity to reduce network costs for consumers. However, a first-principles review of electricity network regulation is necessary to ensure those benefits can translate to better consumer outcomes.

Recommendations

1	**Federal and state governments should commit to halve household energy bills over the next decade.** This should be based on a roadmap to roll out the technologies discussed in this report, accompanied by a policy pathway to deliver them.
2	**Minimum energy performance standards should be expanded and increased** to discourage installation of gas or inefficient electric appliances, and encourage installation of efficient and flexible electric appliances.
3	**A comprehensive, national incentive scheme for energy upgrades should be implemented.** This could involve expanding the Victorian and/or New South Wales incentive schemes nation-wide, or by expanding and extending the federal Small-Scale Renewable Energy Scheme. The scheme should support demand flexibility measures, extend beyond 2030, and consider the wide range of equitable funding approaches.
4	**Fairer electricity pricing structures should be provided for consumers** that offer reasonable rewards for efforts to reduce peak demand. This should include improved tariffs, and well-designed, well-regulated Virtual Power Plants that support the interests of consumers and the grid. This should be considered as central to the Australian Energy Market Commission's ongoing electricity pricing review.
5	**A first-principles review of the economic regulation of gas and electricity networks should be undertaken.** This should be led by an independent panel with expertise in economic regulation, competition policy and consumer energy resources. The review should re-evaluate the cost recovery approach for energy networks to fairly reflect the diminishing value of some assets (such as the gas distribution network asset base), while providing the right incentives to support wider uptake of consumer energy resources.

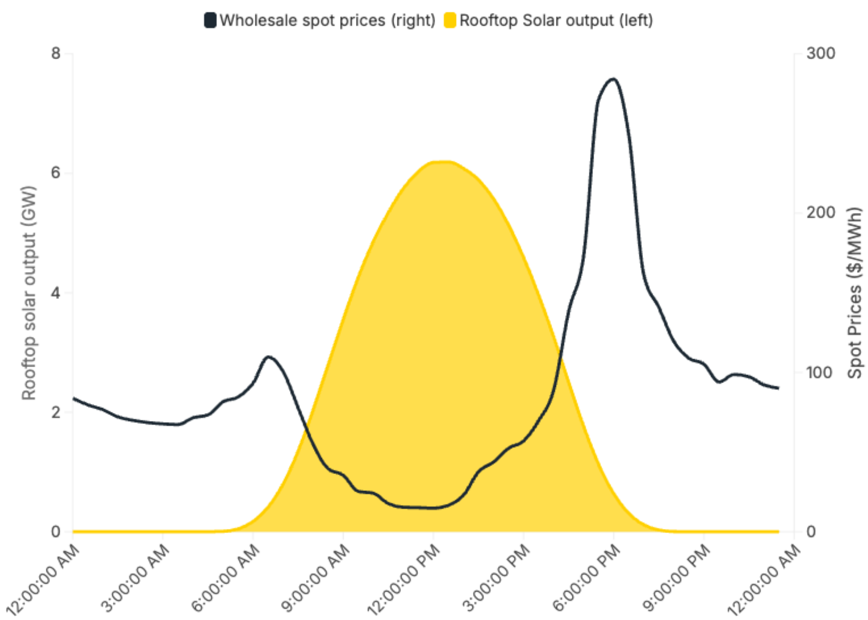
Australia has all the ingredients to reduce energy costs

Very few countries have seen such a rapid expansion in solar and wind as Australia. Ten years ago, wind and solar generated 5% of electricity in Australia's National Electricity Market (NEM). As of the publication of this report, it is 36%.[1]

Rooftop solar is arguably the most remarkable part of this transition. More than one in three Australian households now have solar panels on their roofs.[2] At a large scale, solar is now the cheapest form of new electricity generation available in Australia.[3]

Solar has had a profound impact on Australia's wholesale electricity markets, sending midday prices plummeting to very low (often negative) levels on most days of the year (Figure 1).

Figure 1: Average daily spot electricity prices and rooftop solar output in the NEM, FY2023-24



Source: Australian Energy Market Operator (AEMO)[4]. Note: spot prices are volume-weighted averages across NEM regions.

Households with rooftop solar are experiencing the most direct benefits of this transition, but the growth of solar has had a positive impact for all consumers, who are paying less for electricity today than they would be if Australia had not embarked on its renewable transition.[5]

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[1] OpenElectricity. Comparing wind and solar contribution to demand for FY2015 against FY2025. Accessed 3 June 2025.
[2] Based on four million rooftop solar installations (Clean Energy Council. Clean Energy Australia 2025. 28 May 2025. Page 69) and 10.6 million total households (ABS. Projected households, Australia, series II.)
[3] CSIRO. GenCost 2024-25. Consultation Draft. December 2024. Page 28.
[4] AEMO. Market Data NEMWeb.
[5] Clean Energy Investor Group. The Cost of No Renewables. March 2025. Page 8; Griffith Business School. The Counterfactual Scenario: are renewables cheaper? June 2025. Page 1. *P Simshauser & J Gilmore*.

So why are Australians continuing to struggle with high power bills?[6]

Rising energy prices have coincided with high levels of inflation across the economy, and the rising cost of living has emerged as one of the most pressing concerns facing Australian households today.

The downward pressure from low-cost solar has been offset by large rises in gas and coal prices, declining reliability of older coal power plants, and rising network costs.[7] As a result, retail energy prices are continuing to rise, with the Australian Energy Regulator (AER)'s most recent Default Market Offer (DMO) determination passing through price rises of as much as 9.7% per consumer.[8]

States and federal governments have responded to rising energy costs by providing one-off energy bill rebates.[9] However, these rebates offer only temporary relief, and do nothing to address the underlying drivers of high energy costs. Governments have also debated measures to reduce the price of energy. While this is a worthwhile policy focus, it misses the fact that energy bills can be lowered by reducing the amount of energy households need to purchase from the grid.

This report focuses on three overlooked yet highly significant drivers behind high household energy bills in Australia:

1. **Many households continue to rely on expensive gas.**
   Fossil gas prices have risen faster than electricity prices.[10] This has been exacerbated by the development of a gas export industry in Australia that has exposed our market to global prices.[11] Furthermore, gas appliances are typically the least efficient type of household appliance.[12]

2. **Most homes use energy inefficiently.**
   Most Australian homes were not subject to energy efficiency standards prior to 2003, and as a result, the existing housing stock is notoriously inefficient.[13] While all-electric homes are common in many regions, it is also common for homes to rely heavily on inefficient electric appliances.

3. **Most household energy consumption occurs when the sun isn't shining.**
   Household energy demand is concentrated towards evening peak periods – when solar generation is either winding down or has stopped. This results in the grid calling on the most expensive form of power generation – gas – which is correlated with higher electricity prices.[14]

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[6] Australian Council of Social Service (ACOSS). Heat in Homes Survey Report. March 2025. Page 41.
[7] IEEFA. Why are power bills higher now than they used to be? 20 March 2025.
[8] AER. 2025-65 Default market offer prices – Final determination. 26 May 2025. Page 1.
[9] For example see the Energy Bill Relief Fund (Commonwealth), Energy Bill Relief for Households (Queensland), and Household and Small Business Electricity Credit (Western Australia).
[10] Senate Economics Reference Committee. Residential Electrification. March 2025. Page 15.
[11] IEEFA. Australian gas users pay price as LNG exporters prioritise spot market windfall. February 2025. Page 3.
[12] IEEFA. Appliance standards are key to driving the transition to efficient electric homes. April 2024. Page 2.
[13] CSIRO. Australians reach for the stars when it comes to energy efficient homes. 26 June 2019.
[14] IEEFA. Why are power bills higher now than they used to be? March 2025. Page 5.

This report discusses several types of household energy upgrades that offer solutions to these challenges. They allow homes to put Australia's low-cost solar to better use, reducing energy bills and cutting peak electricity demand (Table 1).

Table 1: Household energy upgrades considered in this report

	Thermal efficiency upgrades	Improving the thermal properties of a home can lower its heating and cooling costs, as well as improving its ability to manage peak demand.
	Upgrading to efficient electric appliances	Reverse-cycle air conditioners, heat pump hot water systems and induction cooktops consume far less energy than gas appliances or resistive electric appliances.
	Installing rooftop solar	Rooftop solar allows homes to avoid purchasing grid electricity for some of their energy needs, while making a small income from exporting any excess solar generation to the grid.
	Installing a household battery	Household batteries allow homes to store any excess solar in the middle of the day, and shift it to meet energy consumption during the evening and overnight.
	Pre-heating and pre-cooling	Thermally efficient homes that aren't occupied in the middle of the day can set their air conditioners to pre-heat or pre-cool the home to reach a comfortable temperature by the evening, offsetting some of their evening heating and cooling demand.

Our analysis draws from a new IEEFA model that analyses hourly energy consumption for typical households in different regions of Australia throughout the year.

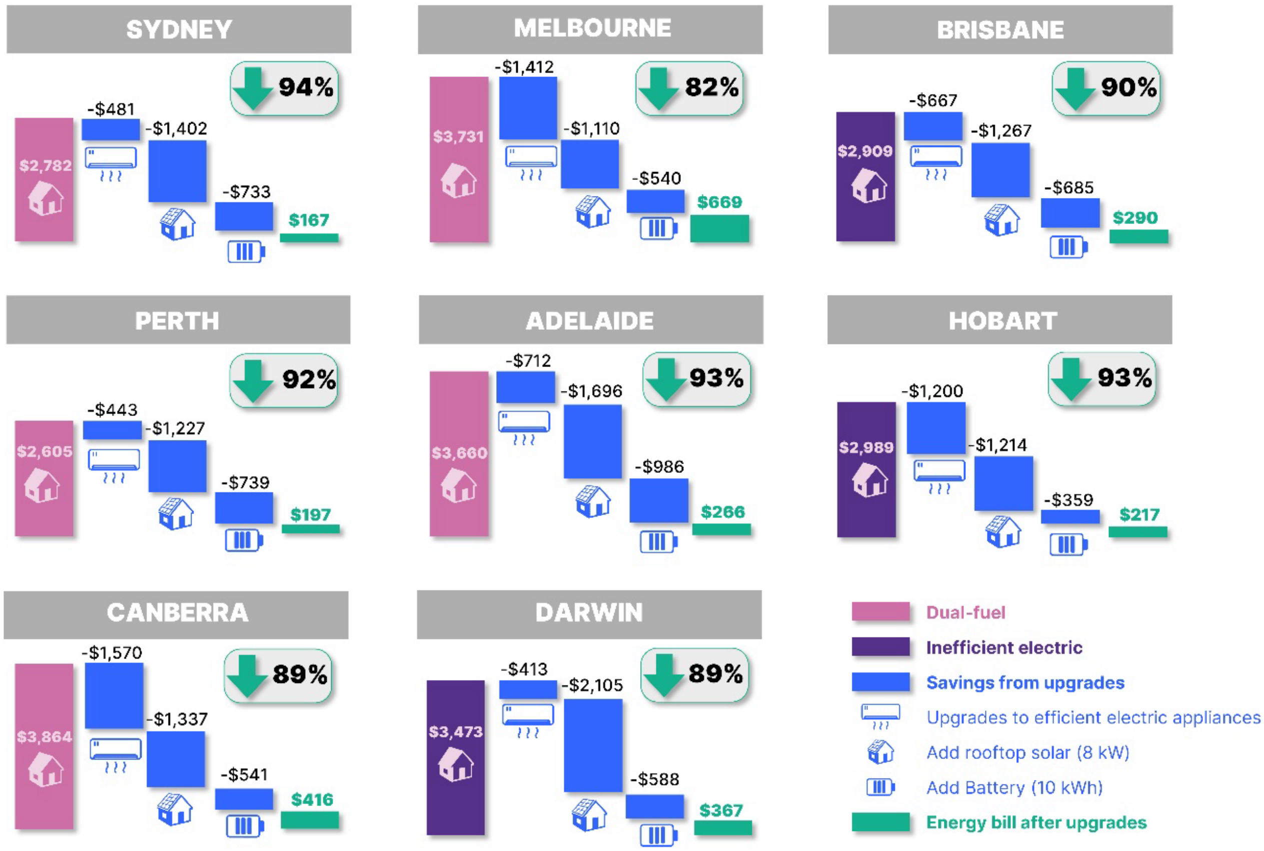
As a starting point, we have looked at the impacts of energy upgrades on a typical dual-fuel home in most capital cities. For Brisbane, Hobart and Darwin, where residential gas consumption is less widespread, we have instead used a typical household with inefficient electric appliances as a starting point.

More details on the modelling, including key assumptions and detailed results, can be found in the Technical Appendix.

Household energy upgrades would slash bills

Our modelling found that upgrading to efficient electric appliances, installing rooftop solar and adding a battery could deliver savings in the range of 82-93% for a typical household (Figure 2).

Figure 2: Energy bill savings from appliance upgrades, rooftop solar and batteries



Note: Figure shows estimated annual savings from a range of household energy upgrades for typical homes by capital city.

While these are extraordinary savings, the underlying drivers are simple.

Switching to efficient electric appliances dramatically reduces energy consumption

Gas appliances are typically the least efficient form of household appliance, and gas prices are rising faster than electricity prices.

Switching gas appliances to efficient electric appliances saves consumers between $443 and $1,570 a year, with a major component being the fixed charges that households avoid by disconnecting from the gas network entirely.[15]

[15] Based on the tariffs collected in our model, this ranges from $115/year in Western Australia to $331/year in Victoria.

In regions where residential gas consumption is less common (such as Queensland, Tasmania and the Northern Territory), there is still a high reliance on inefficient electric appliances, such as resistive electric hot water systems and resistive electric heaters.[16]

Switching these to efficient electric appliances like reverse-cycle air conditioners, heat pump hot water systems and induction cooktops saves households between $413 and $1,200 a year.

Rooftop solar significantly reduces consumption from the grid

Rooftop solar enables households to reduce their grid consumption in the middle of the day.

We have modelled the impacts of installing an 8 kilowatt (kW) rooftop solar system on a typical home. This is representative of the typical size of a new rooftop solar system installed today, though the size of new installations has grown over time and is likely to continue to grow.[17]

We found this rooftop solar system could meet most or all of the midday energy requirements for a typical home with efficient electric appliances in most parts of the country, saving them $1,110 to $2,105 per year.

Batteries displace most remaining grid consumption

Households with efficient electric appliances and rooftop solar will still need to draw energy from the grid overnight, or on days when solar output is low. With an 8kW solar system, they will also usually have more rooftop solar than they can consume in the middle of the day. While this can be exported to the grid in exchange for modest feed-in tariffs, storing this excess solar energy in a battery can extract more value from it.

Our modelling found that adding a 10 kilowatt-hour (kWh) battery to a home with efficient electric appliances and rooftop solar could cut a further $359-$986 from the remaining energy bill.[18]

In fact, we found that on an average day in many months of the year, households in many regions may have no need to draw electricity from the grid at all.[19]

[16] Previous IEEFA analysis has estimated about 800,000 inefficient electric appliances are installed each year, compared with 940,000 gas appliances.
[17] Green Energy Markets for AEMO. Projections for distributed energy resources – solar PV and stationary energy battery systems. December 2024. Page 20.
[18] The typical size of a new residential battery system in Australia is above 10kWh. (PV Magazine. SunWiz details sharp rise in residential battery install volumes. 3 June 2025.) These results assume the battery is operated to divert excess rooftop solar for household self-consumption. Other modes of operating the battery could yield additional income, which is discussed later in the report.
[19] Based on averaged daily electricity consumption profiles for each month of the year. Households may draw greater amounts of electricity from the grid on days with high demand and/or low solar output.

Thermally efficient homes have the lowest running costs

The modelling results in Figure 2 focus on a 'typical' household in each capital city – representing the average thermal properties across Australia's housing stock. This "typical" household is often very hard to keep warm in winter, and cool in summer.

Weak thermal efficiency standards were first introduced for Victorian homes in 1991, but it was not until the mid-2000s that these standards began to be ramped up and implemented in other states and territories.[20]

While thermal efficiency standards have been ratcheted up over the past two decades, older, poor-performing homes still dominate Australia's existing housing stock.

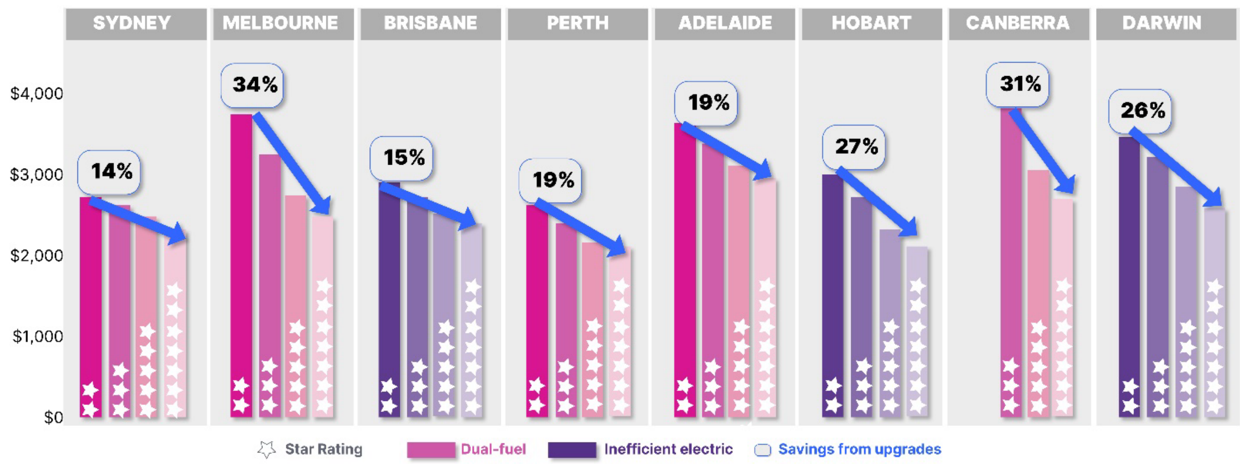
The National Home Energy Rating Scheme (NatHERS) rates the thermal efficiency of Australian homes on a scale of 0 (no thermal performance) to 10 (effectively meeting the standard for a "passive house").[21] While data on the performance of existing homes is very poor, the average rating is likely to be about 2 stars.[22]

In the Australian Capital Territory (ACT), where a mandatory disclosure scheme for home energy efficiency has existed for several years, evidence suggests the existing average home is now closer to 3-star equivalent.[23]

Figure 3 shows how significant the impact of thermal efficiency can be. In Melbourne for example, a 7-star home is likely to consume about two thirds of the energy of a 2-star home.

[20] Australian Greenhouse Office. Impact of Minimum Performance Requirements for Class 1 Buildings in Victoria. 2000. Page 8; Australian Building Codes Board. Media release: New energy efficiency measures for Buildings. 25 November 2005.
[21] Department of Climate Change, Energy, the Environment and Water. Nationwide House Energy Rating Scheme. Thermal Star Rating. Accessed 3 June 2025.
[22] Prior to the introduction of star ratings in 2003, the average home was about 1.8 stars. As very long-lived assets, the housing stock is likely dominated by these older, poor-performing dwellings.
[23] Common Capital. Review of the ACT Energy Efficiency Rating Disclosure Scheme. 24 March 2023. Page 3.

Figure 3: Energy bills by NatHERS star rating



Note: Annual energy bill for a typical household (dual-fuel or inefficient electric) by NatHERS star rating and capital city. Annotations show reduction in energy bill for a 7-star home compared with the lowest-star home analysed.

Peak demand matters for all energy users

While household energy upgrades present clear and direct savings for the consumers that invest in them, they also have implications for all energy users, by affecting peak demand on the grid.

Electricity generation and network assets are built to meet the maximum potential level of demand that could occur throughout the year. This peak usually occurs under hot summer conditions in most regions, except for Tasmania where peak demand occurs in winter.[24]

Reducing peak demand can reduce the amount of expensive sources of flexible generation – mostly gas – that is needed during peak times.[25] This can then reduce the wholesale price of electricity across the whole market.[26]

In principle, reducing peak demand should also reduce the level of investment required in electricity networks, and create opportunities to use existing network assets more efficiently.[27] This should ideally flow through to lower network prices for consumers.[28]

The modelling in this report has not analysed the highest peak day conditions for a given year. However, we have modelled how different household energy upgrades shape a household's peak

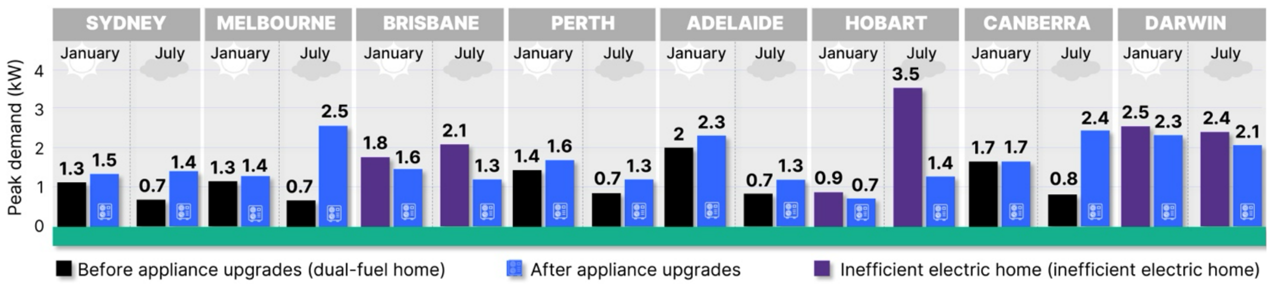
[24] AER. Seasonal peak demand – regions. Accessed 3 June 2025.
[25] NERA Economic Consulting for ARENA. Valuing Load Flexibility in the NEM. 1 February 2022. Page 100.
[26] For example, see Energeia for AEMC. Benefit Analysis of Load-Flexibility from Consumer Energy Resources. 6 March 2025. Page 33.
[27] Baringa for Energy Security Board. Potential network benefits from more efficient DER Integration. 18 June 2021. Page 23.
[28] Later in this report, we discuss how regulatory reform may be necessary to realise these benefits.

demand on an average day throughout the year. This provides a useful guide for the direction and magnitude of impact that each upgrade could have.

Efficient electric appliances affect peak demand in either direction

Upgrading to efficient electric appliances will have one of two impacts on peak demand, depending on which type of appliances are being replaced (Figure 4). Switching from inefficient to efficient electric appliances decreases peak demand. Moving from gas to efficient electric appliances increases peak (electricity) demand, while reducing gas demand more extensively. The differences are more pronounced in winter than summer, due to the impact of heating loads.[29]

Figure 4: Impact of appliance upgrades on average evening peak demand



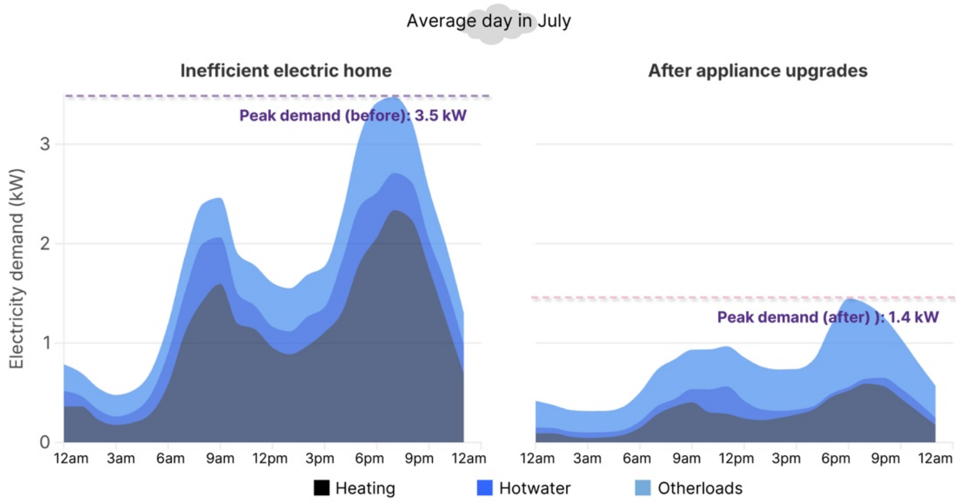
Note: Figure shows the estimated impact on peak demand of upgrading to efficient electric appliances on an average day in January and July, by capital city.

Upgrading from inefficient to efficient electric appliances

Figure 5 illustrates an example load profile for a Hobart home in July. This home has a high heating demand, met via resistive electric heaters. Like most Tasmanian homes, it also relies on a resistive electric hot water system and cooktop.

[29] As reverse-cycle air conditioners are already commonly used for cooling across Australia, future improvements in cooling appliance efficiency are likely to be incremental.

Figure 5: Illustrative load profile when upgrading from inefficient to efficient electric appliances



Note: Figure shows an illustrative load profile for the example of a typical Hobart home in July, before and after upgrading from inefficient to efficient electric appliances.

Upgrading inefficient electric appliances to efficient alternatives leads to a 57% reduction in overall electricity demand on an average July day – with the majority being for heating. This translates into a 58% reduction in peak evening demand.

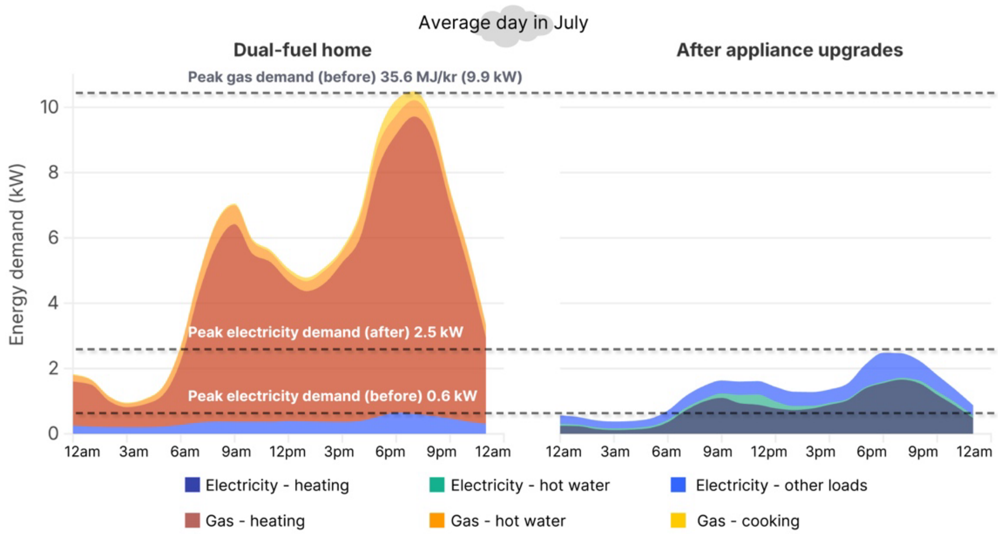
While inefficient electric appliances are especially common in some regions such as Tasmania, they are used throughout all states and territories. Resistive electric hot water systems are the most common form of hot water system in New South Wales.[30] Even Victoria, with its high reliance on residential gas, has many regional areas with no reticulated gas network, where inefficient electric appliances are common.[31]

Upgrading from gas to efficient electric appliances

Figure 6 illustrates an example load profile for a Melbourne home in July, after gas appliances are switched to efficient electric alternatives.

[30] EnergyConsult. 2021 Residential Baseline Study for Australia and New Zealand for 2000 to 2040. 11 November 2022.
[31] For further detail on the relative size of the opportunity from upgrading gas, and inefficient electric appliances by state and territory, see IEEFA. Appliance standards are key to driving the transition to efficient electric homes. 23 April 2024.

Figure 6: Illustrative load profiles when upgrading from gas to efficient electric appliances



Note: Figure shows illustrative load profiles (gas and electricity) for a typical Melbourne home in July, before and after upgrading from gas to efficient electric appliances.

The most dramatic impact of this upgrade is the removal of gas loads, which previously made up the vast majority of winter energy consumption.

This reduction benefits other energy users – particularly industrial gas users – by freeing up gas during winter when supply may become increasingly constrained. The Australian Energy Market Operator (AEMO) has warned that southern regions including Victoria may face peak day shortfalls of gas as early as 2028.[32]

Efficient electric appliances typically use between 12% and 50% as much energy as a gas appliance, meaning that the increase in electricity demand is nowhere near the magnitude of the gas demand it replaces.[33]

Nonetheless, electrification of gas appliances in Melbourne leads to an increase in electricity demand during winter. Figure 4 shows that after efficient electrification, peak demand on an average day in winter is likely to be higher than on an average summer day.

This raises the possibility that, as large numbers of households electrify, annual peak demand in Victoria could eventually shift from summer to winter.

[32] AEMO. Gas Statement of Opportunities. March 2025. Page 3.
[33] IEEFA. Appliance standards are key to driving the transition to efficient electric homes. April 2024. Page 2.

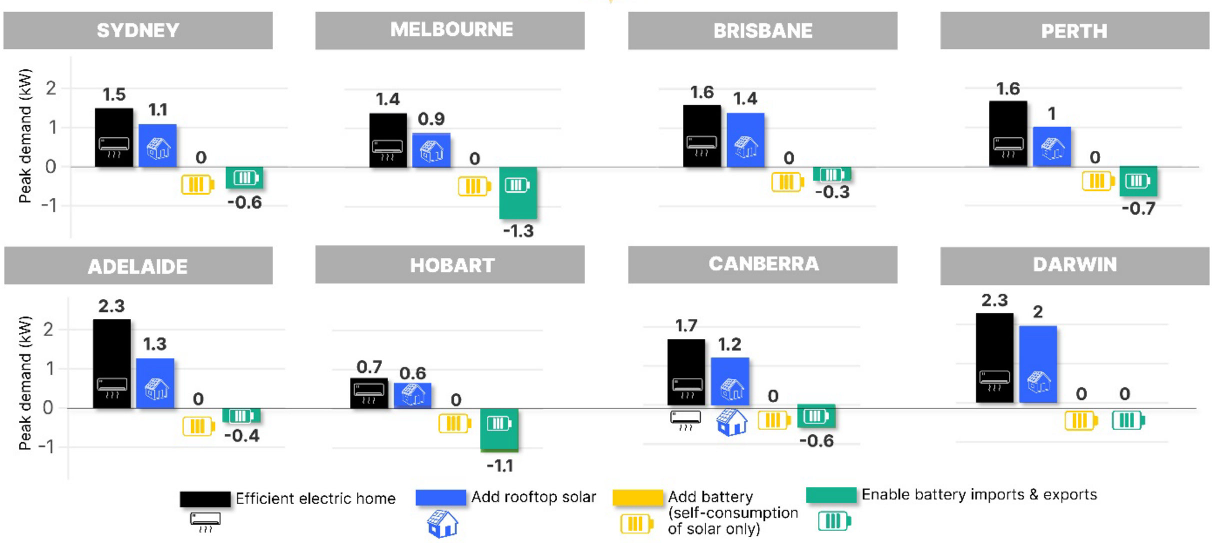
In practice, this shift is likely to take many years to eventuate. System-wide peak demand in Victoria is typically between 1.3GW and 2GW higher in summer than in winter, and it may take considerable time to electrify the large number of gas-consuming households in Victoria.[34]

However, this highlights that as Victorian households shift off gas, it will be important to ensure they switch to efficient electric appliances and take up opportunities to reduce winter peak demand. The following sections present some effective approaches to manage this.

Solar and batteries consistently reduce summer peak demand

While rooftop solar delivers most of its value to households during the middle of the day, our modelling found it also delivers noticeable demand reductions at peak times in summer in all regions (Figure 7).

Figure 7: Impact of rooftop solar and batteries on average January peak demand



Note: Figure shows impact of rooftop solar and batteries on peak demand for an average January day in each capital city. Based on households that have already upgraded to efficient electric appliances.

When a battery is added, this can often meet a household's full energy requirements during the evening, effectively eliminating any peak demand contribution on a typical day.

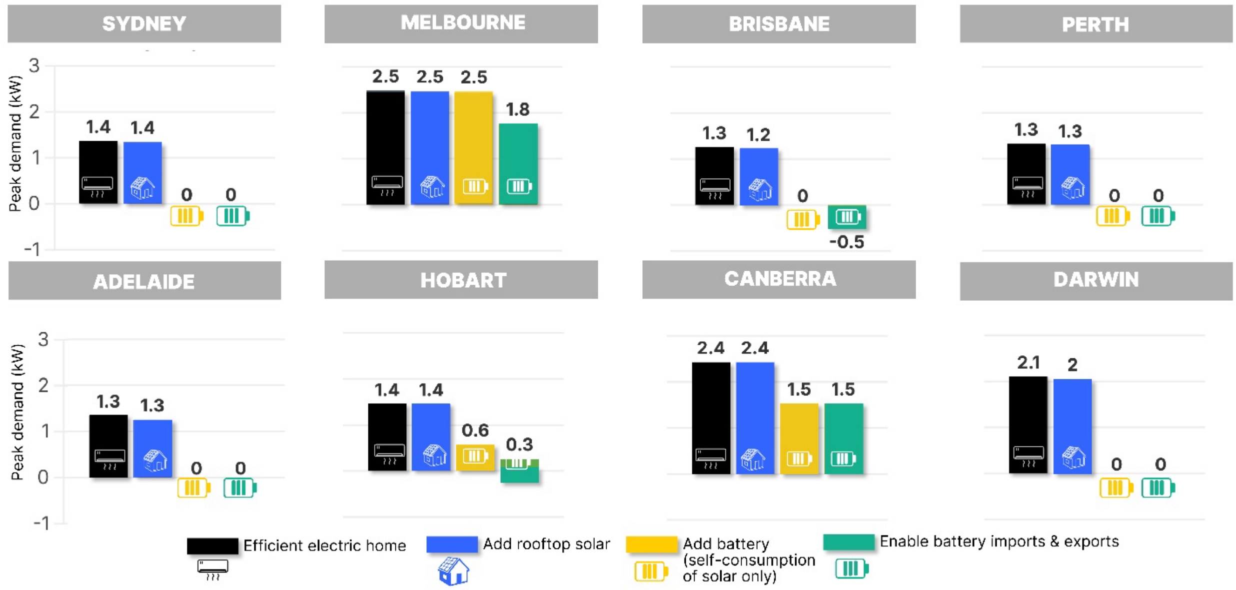
In fact, most households we modelled had excess battery charge available after fully meeting their daily household energy needs on a typical summer day. Those households could export energy to the grid during the evening peak period – meaning they not only reduce their own peak demand impacts, but also offset those of other users.

[34] Based on average difference in winter vs summer peak demand in the past 10 years, excluding years where summer peak demand was significantly lower than usual. AER. Seasonal peak demand – regions. Accessed 20 June 2025.

Battery imports and exports become important in winter

During winter, rooftop solar alone does not deliver noticeable peak demand reductions, as the evening peak mostly occurs after sunset (Figure 8).

Figure 8: Impact of rooftop solar and batteries on average July peak demand

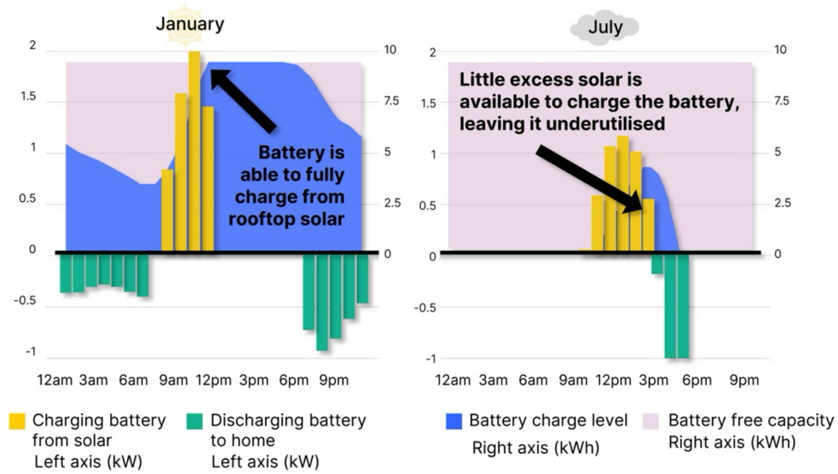


Note: Figure shows impact of rooftop solar and batteries on peak demand for an average July day, in each capital city. Based on households that have already upgraded to efficient electric appliances.

Adding a battery, charging it from excess rooftop solar, and discharging it to meet the home's own energy demand will reduce or even eliminate evening peak demand in most regions. However, it has a limited effect in cooler regions such as Melbourne, Hobart and Canberra.

In these regions, low winter solar output coincides with high heating demand, leaving not enough excess solar to fully charge the battery in winter. This may limit the battery's ability to reduce evening grid electricity demand (Figure 9).

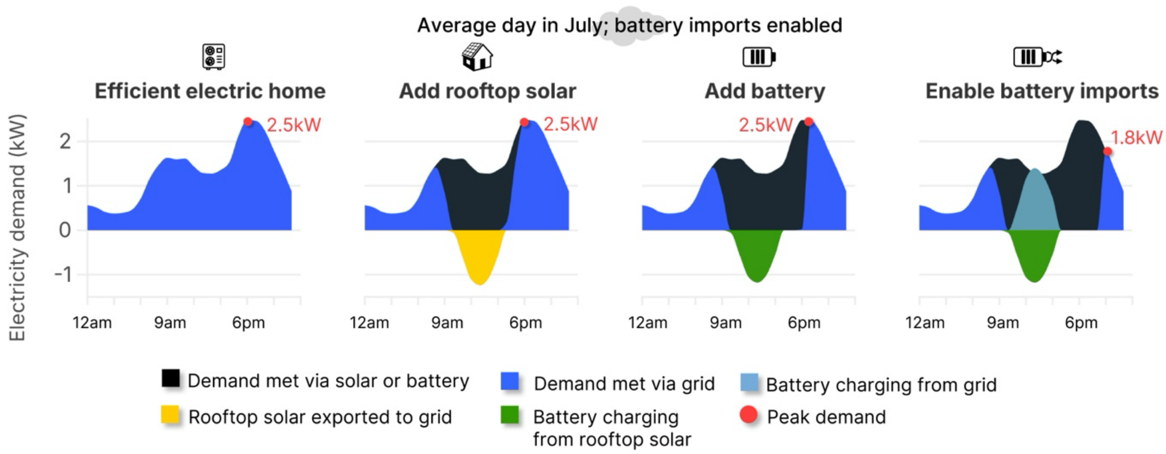
Figure 9: Modelled outcomes for battery utilisation in Melbourne, January vs July



Note: Figure shows modelled outcomes for battery utilisation in Melbourne in January vs July, showing the battery may be fully utilised in summer, but underutilised in winter if it is not importing from the grid. Based on a home with efficient electric appliances, 8kW rooftop solar and a 10kWh battery.

There is a straightforward solution to this challenge: import energy from the grid to the battery during low demand periods. Figure 10 shows how allowing the battery to import from the grid in Melbourne during winter allows that battery to reach full charge, and provide a more meaningful reduction in peak demand. We have assumed these imports occur during the middle of the day when, even during winter, wholesale electricity prices in Victoria are very low.[35]

Figure 10: Impact of rooftop solar and batteries on July peak demand



Note: Figure shows an example of grid consumption for an efficient electric home in Melbourne in July, showing the impact of adding rooftop solar and a battery (before and after enabling grid imports) on peak demand.

[35] For example, the average wholesale electricity price in Victoria in winter 2024 was $80.70 per megawatt-hour (MWh) between 10am and 2pm. This was nearly half the daily average price of $152/MWh, and nearly a quarter the average 5pm-9pm price of $280/MWh (Market Data NEMWeb, AEMO).

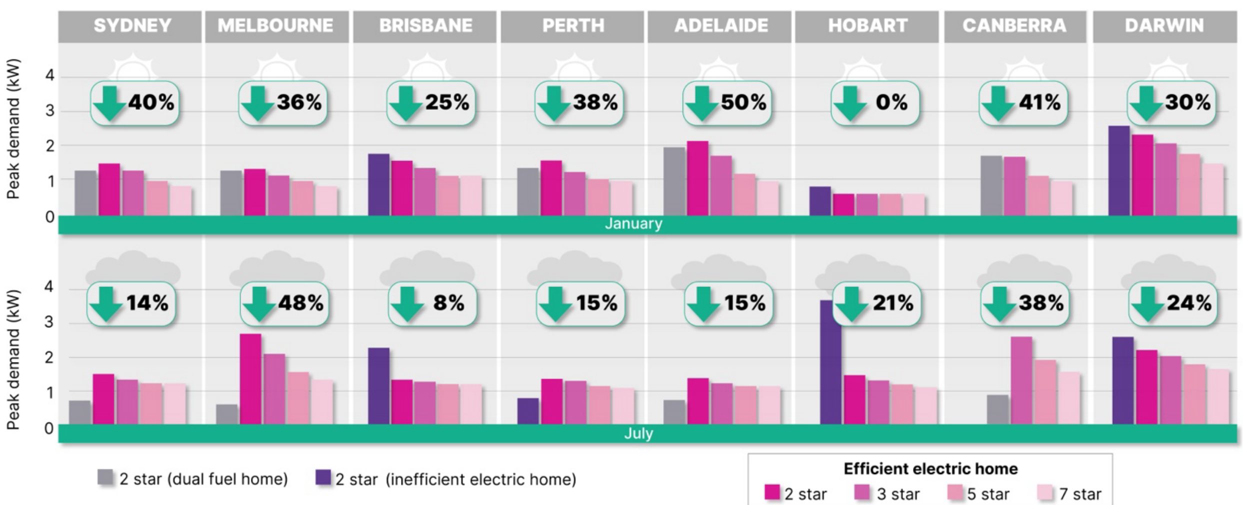
Thermally efficient homes have more peak reduction potential

The benefits of more thermally efficient homes are not limited to lower energy bills and greater comfort. Our modelling identified a number of ways in which thermal efficient homes can deliver peak demand reductions.

Thermally efficient homes have lower average peak demand by default

By default, homes that are more thermally efficient will have lower electricity demand at all times, including peak periods. Figure 11 shows the difference in peak demand between a typical home in each state, and a 7-star home (the current minimum standard for new homes in most states and territories). The difference, before considering other upgrades, is as high as 50% in January (Adelaide), or 48% in July (Melbourne).

Figure 11: Peak demand for typical homes, by NatHERS star ratings



Note: Figure shows peak demand on an average day in January and July, for homes with increasing NatHERS star ratings, across all capital cities. Annotations indicate the difference in peak demand of a 7-star home compared with a 2-star home (or 3-star in Canberra), both with efficient electric appliances.

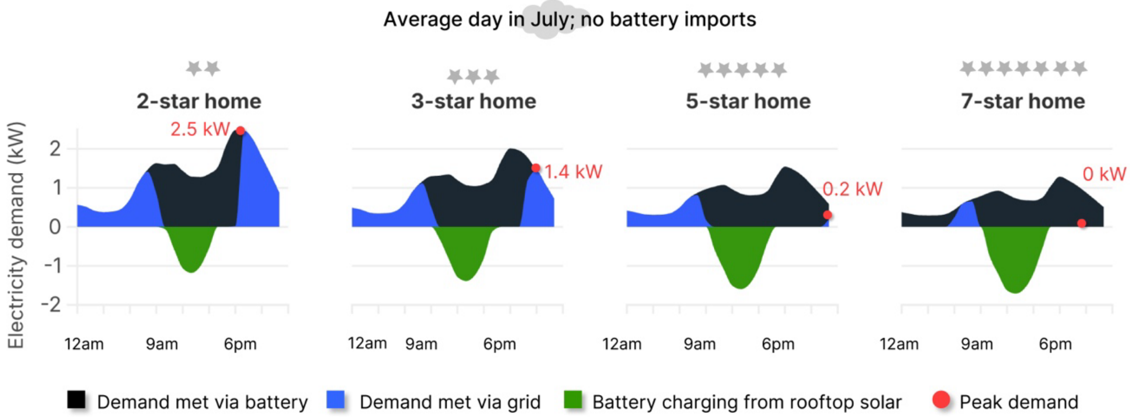
Batteries go further in thermally efficient homes

Previous sections discussed how batteries can play a key role in reducing peak demand, but that their potential was more constrained in winter in colder regions such as Melbourne, where high heating loads may absorb much of the available rooftop solar during the day.

However, thermally efficient homes have lower overall heating loads. This leaves them with more excess solar available to charge the battery, and therefore more potential to deliver peak demand reductions in the evening.

Figure 12 shows that peak demand on an average July day in a 7-star home in Melbourne (with efficient electric appliances, rooftop solar and a battery) is 48% lower than a 2-star home.

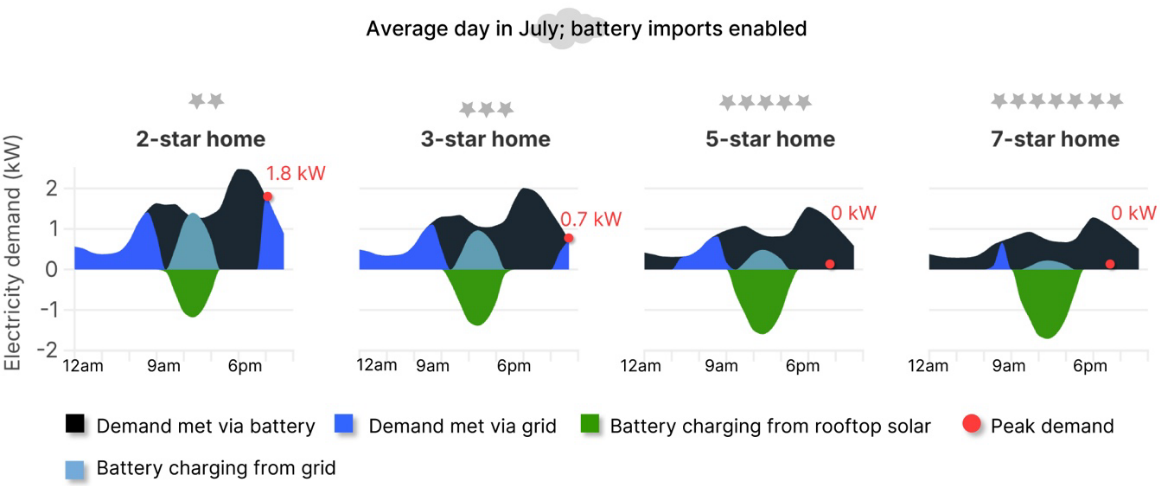
Figure 12: Impact of household star ratings on July peak demand reduction following battery installation



Note: Figure shows example load profiles for an efficient electric home in Melbourne in July, showing that homes with higher star ratings can achieve deeper peak demand reductions from installing a battery.

The result in Figure 12 assumes the battery is charging only from rooftop solar. If we reintroduce the ability for that household to charge its battery from the grid, the effect is even more pronounced (Figure 13).

Figure 13: Impact of household star ratings on July peak demand reduction following battery installation with grid imports enabled



Note: Figures show example load profiles for Melbourne in July, showing the compounding effect of enabling battery grid imports in more thermally efficient homes.

Thermally efficient homes can be pre-heated and cooled

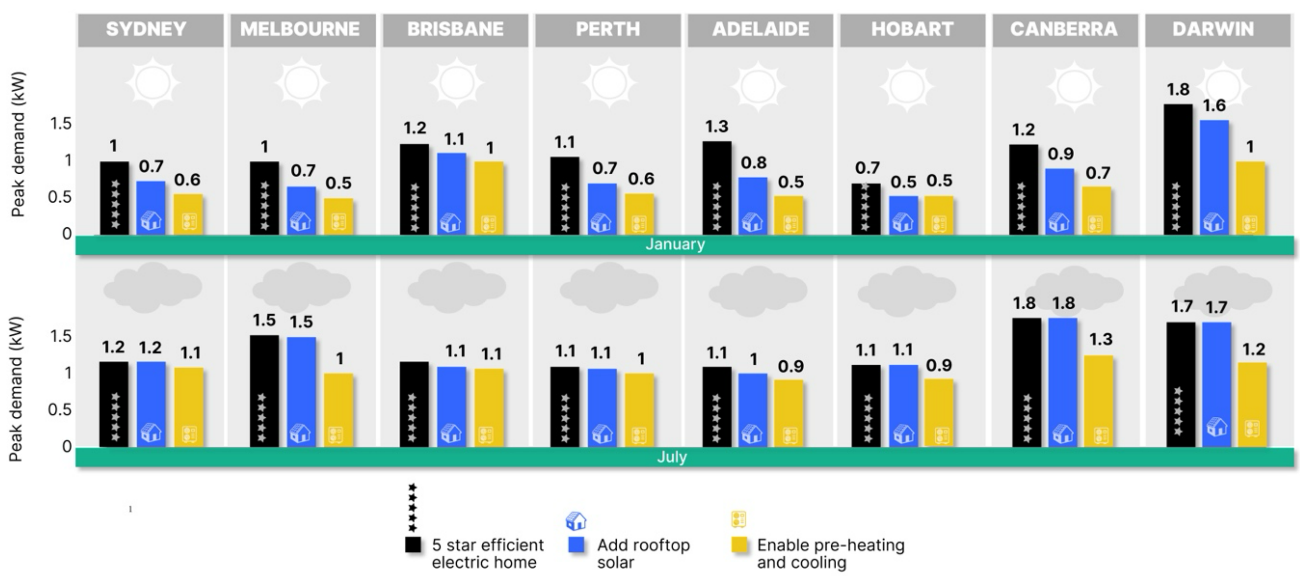
Batteries reduce peak demand by shifting excess energy production from the middle of the day to the evening peak period. However, a similar effect can be obtained by shifting the underlying energy load itself away from peak periods.

Most homes can engage in some form of load-shifting. For example, our modelling assumes that homes that upgrade to a heat pump hot water system will set the system to operate in the middle of the day. Smaller, non-time sensitive energy loads such as washers, dryers and dishwashers can also be set to operate on timers, though we have not analysed this in our modelling.

However, most households may not consider shifting their heating and cooling loads to the middle of the day. And admittedly, this would offer little value for a typical thermally inefficient Australian home, as any heat or coolth added to the home in the middle of the day is likely to be lost by the time it is most needed in the evening.

But thermally efficient homes do have this opportunity – effectively using their home as a thermal battery to store warmth or coolth in the middle of the day.[36] Figure 14 shows the change in average peak demand for a 5-star home that adds rooftop solar and then uses its excess rooftop solar to heat or cool the home in the middle of the day, offsetting the need to run air conditioning in the evening.

Figure 14: Impact of rooftop solar and pre-heating and cooling on evening peak demand



Note: Evening peak demand on an average day in January and July, for a 5-star efficient electric home in each capital city, showing the impact of rooftop solar and pre-heating and cooling. Annotations show the reduction in peak demand attributable to pre-heating and cooling (compared to a home with just solar).

[36] Our modelling draws key assumptions on pre-heating and cooling from RACE for 2030. H1 Opportunity Assessment – Residential solar pre-cooling and pre-heating. November 2021.

While the peak demand reductions offered by pre-heating and cooling are not as strong as for a battery, it presents a viable alternative that could deliver some meaningful reductions at a fraction of the cost of a battery.

It is particularly impactful during winter in Melbourne, where as previously discussed, there is value in reducing peak demand. And it is important to note that while most homes fall well below a 5-star standard, it is likely that about one quarter of Victorian homes are 5-stars or higher.[37]

Pre-heating and cooling may work better for some households than others – it is particularly suited to homes that are unoccupied in the middle of the day. However, if deployed across all applicable homes, pre-heating and cooling has the potential to deliver material peak demand reduction benefits at a system level.

Household energy upgrades can be cost-effective given the right incentives

The household energy upgrades modelled in this report could deliver significant energy bill savings, significant gas demand reductions and/or significant peak demand reduction benefits. However, most upgrades come with an upfront capital cost.

This section discusses the household financial case for each upgrade.

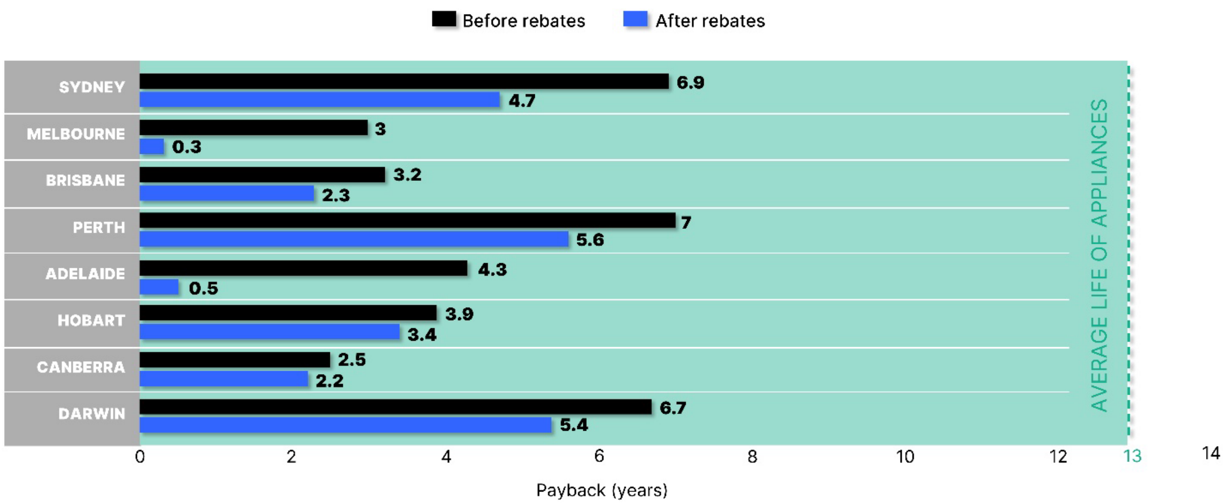
Efficient electric appliances

IEEFA research has shown how the lifetime running cost savings of switching gas or inefficient electric appliances to efficient electric alternatives significantly outweighs the added upfront costs.[38]

Figure 15 shows this upgrade typically delivers a payback of less than five years after government rebates, if it takes place when existing appliances reach their end-of-life. In Victoria and South Australia, where strong state rebate programmes are available, the payback is near-instant.

[37] New Victorian homes have been required to meet a 5-star standard since 2005. (Australian Bureau of Statistics. Feature article: Water and energy efficient elements of households in older and newer dwellings. June 2010.) 676,000 dwellings have been constructed in Victoria since 2005 (ABS), which is approximately 25% of the 2.7 million total dwellings as of 2025 (ABS).
[38] IEEFA. Appliance standards are key to driving the transition to efficient electric homes. April 2024. Page 5.

Figure 15: Payback period for upgrading to efficient electric appliances



Note: Figure shows the payback periods of upgrading to efficient electric appliances in all capital cities at appliance end-of-life. Based on the difference in upfront costs of efficient electric appliances, versus like-for-like gas or inefficient replacements.

For simplicity we have grouped all major appliance upgrades (heating, hot water and cooking) together. In practice, households may make individual investment decisions for each appliance.

We have assumed that consumers will pay an upfront cost to abolish their gas connection in regions where this is a regulated service (currently Victoria and New South Wales only).[39] Gas connection abolishment is generally recommended for energy safety reasons. However, in most regions there is no limit to what gas networks can charge consumers for this service.

Western Australia's ATCO network charges more than $1,200 per abolishment.[40] In South Australia, there are reports of AGN customers being quoted up to $2,500.[41] In practice, many customers will likely opt out of these costs by "temporarily" disconnecting from the gas network, leaving live gas assets on their property.

This is far from ideal from an energy safety perspective. A rule change request has been proposed by the Justice and Equity Centre to improve the approach to gas network disconnections.[42] In the long term, there is a strong need for a co-ordinated approach to decommissioning gas networks in a manner that is safe and cost-efficient.

[39] See AER. AER decision supports Victorian gas consumers in energy transition. 2 June 2023; and AER. Final decision: Jemena Gas Networks (NSW) access arrangement 2025 to 2030. May 2025. Page 42.
[40] ATCO. Permanent Disconnections Service. Accessed 4 June 2025.
[41] One Step Off The Grid. Ombudsman backs customer told it would cost $2,500 to cut gas connection. 20 May 2021.
[42] Justice and Equity Centre. Gas Distribution Network Rule Change Request – Fit for purpose gas disconnection arrangements. 9 May 2025. Page 3.

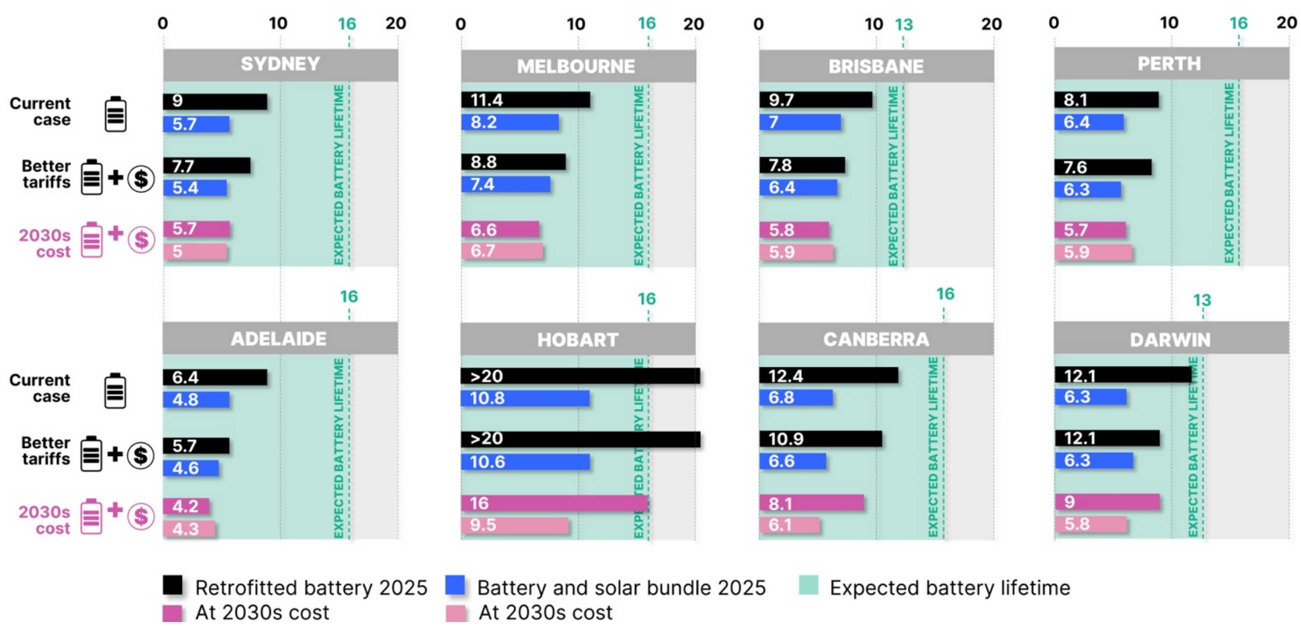
Rooftop solar and batteries

Rooftop solar is broadly viewed as a cost-effective upgrade, having been taken up by about one in three Australian households.[43] Our modelling found the payback on an 8kW rooftop solar system for a home with efficient electric appliances ranged from 3.7 to 7 years including rebates under the federal Small-Scale Renewable Energy Scheme (SRES).

The past year has seen a sharp rise in consumers installing residential batteries – either as a retrofitted addition to an existing solar system, or as a combined bundle with solar and a battery.[44]

Figure 16 shows our analysis of the payback for a retrofitted battery, or for a combined solar and battery bundle, for a typical home with efficient electric appliances. In most regions, the payback of either a standalone battery or battery and solar bundle is well below the typical lifetime of a battery.

Figure 16: Payback period on installation of a 10kWh battery



Note: Payback periods for installing a household battery in all capital cities. Our calculations assume the household has already upgraded to efficient electric appliances and installed 8kW rooftop solar. Rebates are excluded in "2030s costs" scenario, but included in others. Battery lifetime assumed to be 13 years in warm climates, and 16 years in cool/temperate climates.[45]

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[43] Based on four million rooftop solar installations (Clean Energy Council. Clean Energy Australia 2025. 28 May 2025. Page 69) and 10.6 million total households (ABS. Projected households, Australia, series II.)
[44] SunWiz. Battery Attachment Rate Is Surging – And May Soon Exceed 100%. 22 May 2025.
[45] SolarQuotes. How Long Do Solar Batteries Last? 18 August 2023.

The paybacks in Figure 16 include federal government battery rebates that have been introduced as of July 2025, and which are expected to provide a $330/kWh discount on a typical battery (about one third of the 2025 installed cost of $1,000/kWh).[46]

We have excluded state government battery rebate schemes in New South Wales and Western Australia, which have recently been revised to be conditional on batteries being enrolled in a Virtual Power Plant (VPP).[47]

Our modelling revealed battery paybacks are sensitive to a range of factors. For example, the paybacks for larger households, or households with lower daytime energy demand, are likely to be lower than shown in Figure 16.

However, we have explored two particularly important sensitivities in Figure 16:

1. The degree to which consumers are rewarded for importing and exporting to/from the grid ("Better tariffs").
2. The likely continued decline in residential battery prices ("2030s costs").

Current arrangements do not fairly compensate battery owners for services to the grid

Figure 16 shows that under a typical time-of-use tariff and with federal and state rebates, the payback for installing a battery today is below the typical lifetime of a battery in most regions. However, the financial case in regions such as Melbourne is more challenging. This is due to reasons highlighted earlier in the report. If batteries in Melbourne do not import from the grid during winter, they may be underutilised (Figure 9).

We also identified that it was useful for batteries in all regions to export back to the grid in peak times. However, standard electricity plans provide limited incentives to operate batteries in this way. Most retailers offer a fixed feed-in tariff based on the wholesale value of solar in the middle of the day.[48] This provides no additional reward for households that choose to store energy in their battery and export it in the evening.

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[46] Based on a review of quotes shared on the Facebook group *My Efficient Electric Home* as of June 2025, which is consistent with the range of costs reported in SolarQuotes: The Federal Government Battery Rebate: What we know (and what you can do now). Accessed 4 June 2025. Note that many consumers are installing batteries well above 10kWh in capacity, and these typically have much lower unit costs.

[47] SolarChoice. Guide to the NSW Government Home Battery Rebate. 13 June 2025. Accessed 23 June 2025; Energy Policy WA. WA Residential Battery Scheme. 5 June 2025. Accessed 23 June 2025.

[48] With a limited number of exceptions. The Victorian Default Offer provides a time-variable feed in tariff option, but few retailers actually offer this. Electricity distribution networks in New South Wales (NSW) and the ACT have introduced mandatory two-way pricing, imposing a small charge for midday exports and a small benefit for evening exports. However, it is not yet clear if and how retailers will pass this through to customers.

Time-of-use tariffs offer an incentive to charge the battery at the off-peak rate and discharge it later in the day to avoid paying peak rate consumption. But these savings are often modest, and much smaller than the actual value the battery provides to the wholesale market.

Under a "Better tariffs" scenario in Figure 16, we assume the battery can import and export energy at rates based on the average wholesale value of electricity in the middle of the day and evening respectively. Our intention is not to recommend this as a specific tariff structure. However, the findings demonstrate that the payback on a battery is significantly improved when more of the wholesale value of that battery is passed through to consumers.

An increasingly common approach to enable residential batteries to support the grid is to enrol them in a VPP. Typical VPP models involve an operator managing a portion of the battery's capacity, in exchange for providing a fixed annual credit and/or rewards based on how the battery is used.

However, it is very difficult to analyse the financial implications of signing up to a VPP, as there is limited information on how VPP operators typically manage batteries. For example, the battery may not always be prioritised for household self-consumption, and VPPs may not control the battery on every day of the year.[49]

The real value of a household battery to the broader energy system is not limited to its wholesale value. As highlighted by the Australian Energy Market Commission (AEMC), "a single 10 kWh battery in NSW could save the electricity system over $800 in wholesale, network, and ancillary service costs in a year."[50]

Falling battery costs will continue to make them more attractive

The final line in Figure 16 shows the payback on a household battery, under an improved tariffs structure, with an upfront battery cost of about $500/kWh (50% of our base assumption of $1,000). The bundled case also assumes a 20% cost reduction in rooftop solar.

Under this scenario, the financial case for either a standalone retrofitted battery, or a combined battery and solar bundle, becomes highly compelling, with paybacks of around 4-9 years in all capitals except Hobart.

Notably, we have excluded any government rebates in this example, and have not assumed any future increases in retail electricity prices – both factors that would improve the payback even further.

[49] Energeia for AEMC. Benefit Analysis of Load-Flexibility from Consumer Energy Resources: Final Cost-Benefit Analysis. 15 August 2024. Page 56.
[50] AEMC. Discussion paper: The pricing review. June 2025. Page 35.

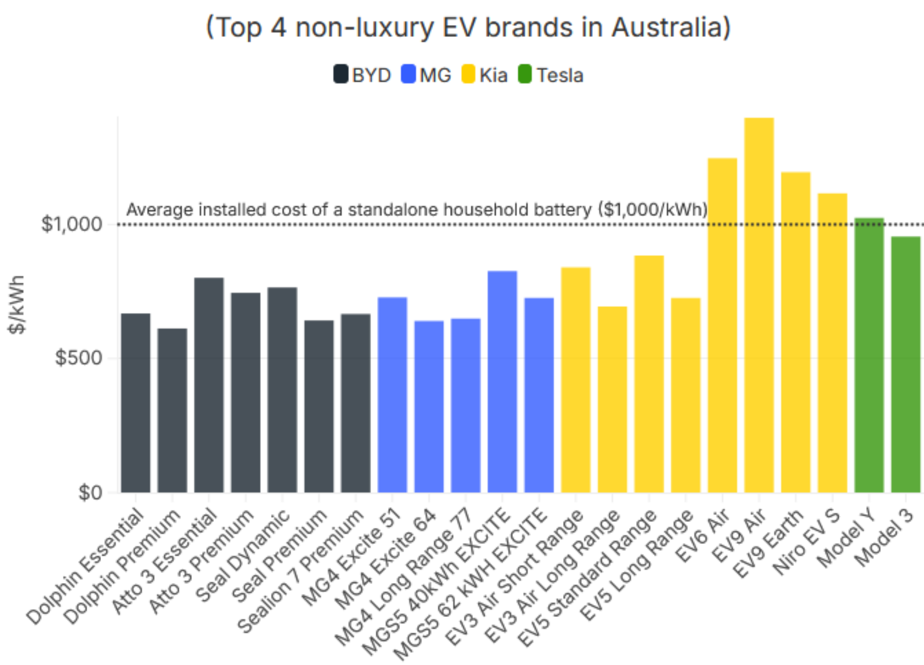
While this is a significant cost reduction – it is not unrealistic. It is not far from some of the cheapest quotes being observed for residential batteries today.[51] It is also in line with expert forecasts of where the average price will fall by the early 2030s.[52]

Batteries on wheels offer the lowest unit cost

A standalone battery is one solution to add household energy storage. But households that purchase an electric vehicle (EV) may find themselves with a battery on wheels that can operate in much the same way.

Many EVs available in Australia today include a battery with capacities of 40-100kWh – much larger than the average size of a standalone residential battery. The cost per kWh of capacity for most EVs is also far lower than the installed cost of a standalone residential battery – but with the added bonus of a car (Figure 17).

Figure 17: Cost of battery capacity for Australia's top four non-luxury EV brands



Source: IEEFA, Canstar.[53] Note: Figure shows the cost per kWh of battery capacity for the main EV models from the top four non-luxury EV brands in Australia. Based on IEEFA analysis of drive-away costs in June 2025 divided by nominal battery capacities. Does not include the cost of a bidirectional charger and inverter.

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[51] Based on a review of battery installation quotes posted by users of the Facebook group My Efficient Electric Home (MEEH).
[52] Green Energy Markets. Projections for distributed energy resources – solar PV and stationary energy battery systems. Report for AEMO. December 2024. Page 42.
[53] Canstar. Top 10 selling electric cars in Australia. 16 April 2025.

Many newer EV models sold in Australia are equipped with the built-in technology to provide vehicle-to-home (V2H) or vehicle-to-grid (V2G) services.[54] However, there are very limited options available for consumers to access this potential. To enable this, governments and vehicle manufacturers will need to agree on regulations, standards and warranty provisions to allow the technology to be cost-effectively utilised.

Considering that about 5.8 million EVs are forecast to be on Australian roads (and more importantly, driveways and garages) by 2035[55], the size of the opportunity from integration of EVs into the grid, once these barriers are removed, is immense.[56]

Pre-heating and cooling

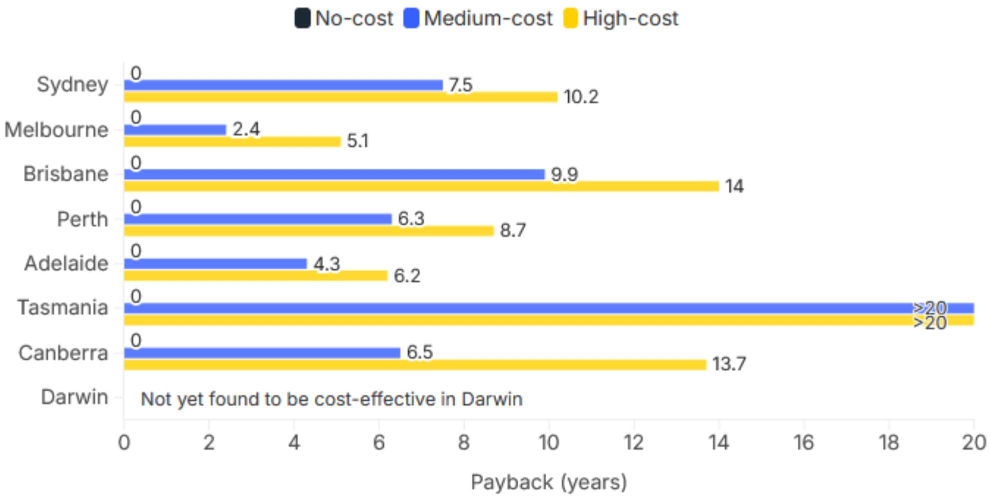
Pre-heating and cooling is an alternative peak demand reduction solution for thermally efficient homes, that is appealing due to the potential for very low upfront costs.

Figure 18 shows the payback period for a five-star rated house with efficient electric appliances and 8kW rooftop solar that chooses to enable pre-heating and cooling. The cost to enable this will differ depending on a household's circumstances, which we have analysed as three scenarios:

- **No cost**
  Households use the existing capabilities of their air conditioner/s to enable pre-heating and cooling. This could be via timer controls or integration with a solar inverter or home energy management system, for models that already include these features. This scenario may require more set-up effort by the consumer.
- **Medium cost**
  Households expend minimum effort, and demand flexibility is instead enabled through standards and regulations. The upfront cost is based on the estimated incremental cost of incorporating "smart controls" into a new reverse-cycle air conditioner, as well as some administrative costs if the user were to enrol in a demand response programme.[57]
- **High cost**
  Households purchase a retrofit "smart" controller for each of their reverse-cycle air conditioners.[58] We assume they can then coordinate pre-heating and cooling via either a timer setting, connecting to their solar inverter, or through a home energy management system.

[54] Zecar. When is V2G Really Coming to Australia? An Energy Insiders Take. 28 November 2024.
[55] CSIRO. Electric vehicle projections 2024. February 2025. Page 48. (Includes all states and territories except NT).
[56] IEEFA. Why Australia is likely underestimating the benefits of electric vehicles. 25 March 2024.
[57] We assume an additional $12 in upfront costs per air conditioner, plus $156 for administrative costs associated with enrolling in a demand response programme (Equipment Energy Efficiency. Regulation Impact Statement for Decision: 'Smart' Demand Response Capabilities for Selected Appliances. October 2019. Page 45.)
[58] i.e. a device equivalent to a Sensibo.

Figure 18: Payback period of enabling pre-heating and cooling



Note: Figure shows payback periods for enabling pre-heating and cooling in each capital city under three cost scenarios. Assumes a household has a 5-star thermal efficiency rating, efficient electric appliances and 8kW rooftop solar.

In most cases, the medium-cost scenario offers payback periods lower than a standalone battery – and of course, the "No cost" scenario presents an instant payback (Figure 18).[59]

However, underlying these paybacks is the fact that the annual savings realised by consumers are relatively small – often below $100/year. Just as for batteries, this reflects a fundamental issue that electricity tariffs are not well designed to reward consumers for what is arguably the primary benefit of pre-heating and cooling – peak demand reduction.

Thermal efficiency upgrades

It is difficult to model generic costs and impacts for thermal efficiency upgrades, as the impact of an individual upgrade will depend heavily on the existing condition and construction type of the house.

This is beyond the scope of this report, and we have not sought to estimate a generic cost for an existing household to upgrade to a higher NatHERS star rating equivalent.

However, it is important to acknowledge that most households have low-cost opportunities to improve thermal efficiency – for example through measures such as draught-proofing, gap-sealing and improving window coverings. Installing or upgrading ceiling insulation is another measure that is generally impactful and cost-effective, and further upgrade options are available at higher cost points.[60]

[59] Other than in Hobart and Darwin, where there is less motivation to engage in pre-heating and pre-cooling due to higher solar feed-in tariffs.
[60] For a qualitative guide on the cost and savings for various home energy efficiency upgrades, see Sustainability Victoria. Household energy action guide. May 2023.

There are additional, significant benefits to thermal efficiency upgrades that are outside the scope of this report. Australian homes frequently fall below or exceed healthy indoor temperature ranges as defined by the World Health Organisation.[61] A study by Sustainability Victoria found that homes that had undergone thermal efficiency upgrades avoided $887 in healthcare costs during winter, compared with non-upgraded homes.[62]

How do we make household energy upgrades happen?

It is difficult to envision alternative options that could deliver the energy bill savings outlined in this report while also providing a solution to manage peak electricity demand. Yet despite many of these upgrades being cost-effective today, very few households are realising their full potential.

Our modelling revealed some potential financial barriers to home energy upgrades – particularly the fact there is insufficient reward for consumers to reduce their peak demand.

Improving the design of electricity tariffs is an important issue. However, simply exposing households to varying electricity prices will not lead to improved outcomes, and there is evidence to suggest that shifting consumers to tariffs with sharper price signals does not in fact change their behaviour.[63]

It has long been observed that uptake of household energy upgrades lags well behind the rates that would logically be expected, given its cost-effectiveness.[64] Two key barriers underly this:

1. **Many households have no ability to invest in home energy upgrades**
   One third of Australians rent their homes. Rental providers have almost no incentive to invest in household energy upgrades, and renters have no ability to make these investments.[65]

   Additionally, many owner-occupier homes do not have access to the upfront capital to invest in upgrades.

2. **Energy consumers are human beings who experience "bounded rationality"**
   Energy policies often assume that providing accurate information to consumers will prompt them to make better, economically rational decisions. If this were true, there would be no reason to publish this report. In reality, consumers experience "bounded rationality" – where a wide range of behavioural factors and cognitive biases lead to decisions that may appear economically irrational.

[61] Energy Research & Social Science. Cold homes in Australia: Questioning our assumptions about prevalence. June 2023. *CF Barlow, L Daniel and E Baker*; and Better Renting. Sweaty and Stressed: Renting in an Australian Summer. March 2023. Page 8.
[62] Sustainability Victoria. The Victorian Healthy Homes Program: Research findings. August 2022. Page 8.
[63] CitiPower. Regulatory Proposal 2026-31. Tariff structure statement: Explanatory statement. January 2025. Page 17.
[64] For example, see Productivity Commission. The Private Cost Effectiveness of Improving Energy Efficiency. 31 August 2005. Page 45.
[65] While cost sharing arrangements have been proposed to work around this issue, these also face challenges. For instance, the insecure nature of rental housing in Australia may deter renters from contributing to long-lived property improvements.

> There is a wealth of information available on the costs and benefits of home energy upgrades. However, everyday consumers lack the time, ability or interest to engage with and process this information in the way that an accounting department of a business might.
>
> To further complicate matters, households are exposed to misinformation, and often receive their primary information from parties who have interests in discouraging upgrades – such as gas appliance manufacturers or installers.
>
> Humans also have a known tendency towards hyperbolic or temporal discounting – even when the relative costs and benefits of an upgrade are clear, we tend to place a very high weight on the upfront cost of an investment, and are reluctant to accept investments with anything beyond a very short payback period.[66]

These barriers cannot be ignored – and we suggest a combined focus on the four policy areas below is necessary.

Standards for efficient, flexible, electric appliances are needed

There is very little justification for Australians to continue installing gas appliances in their homes.

Our modelling highlights the extraordinary amount of energy wasted by homes that burn gas, compared with those with efficient electric appliances. Meanwhile, southern regions of Australia face imminent gas supply gaps and a lack of cost-effective supply options.[67] This places pressure on industrial gas users who may have fewer near-term opportunities to electrify.

Gas distribution networks have also acknowledged they are facing asset stranding risks, and recent regulatory decisions have led to more of these risks being transferred to consumers.[68]

Gas appliances also generate higher greenhouse gas emissions than efficient electric appliances powered either from rooftop solar or a decarbonising grid.[69] Moreover, it is well understood that indoor gas appliances have harmful health impacts, including a link to increased rates of childhood asthma[70].

IEEFA analysis has also shown an increasingly strong case for phasing out the use of fixed resistive electric appliances. These appliances also impose very high running costs, have high peak demand impacts, and when powered from the grid, result in higher greenhouse gas emissions than their efficient electric counterparts.

[66] Renewable and Sustainable Energy Reviews. Household energy use: Applying behavioural economics to understand consumer decision-making and behaviour. January 2015. *E Frederiks, K Stenner and EV Hobman.*
[67] IEEFA. No shortage of solutions to gas supply gap. April 2024. Page 6.
[68] IEEFA. 'Renewable gas' campaigns leave Victorian gas distribution networks and consumers at risk. 17 August 2023. Page 23.
[69] Previous IEEFA analysis found this was the case in Victoria, which has the highest grid Scope 2 emissions factor in Australia. (IEEFA. Managing the transition to all-electric homes. November 2023. Page 13.)
[70] Australian Journal of General Practice. Health risks from indoor gas appliances. December 2022. *B Ewald, G Crisp and M Carey*.

Standards are commonly applied when there is a clear case for a societal transition towards an improved technology. They are particularly important in areas where history has shown that rational consumer decision-making is inhibited, such as home energy upgrades.

Australia has a federal programme to manage appliance standards, the Equipment Energy Efficiency (E3) programme, legislated under the Greenhouse and Energy Minimum Standards Act. The programme provides labelling and minimum energy performance standards for a range of household appliance. However, it is incomplete.

Previous IEEFA research has focused on the case for broadening the E3 programme's standards to cover all types of appliances for the main end uses of space conditioning, water heating and cooking.[71] Minimum energy performance standards could then be increased to ensure new appliances that are sold are efficient and electric.

We have also raised the need to ensure that key appliances are sold with appropriate "smart" standards, allowing their demand response potential to be activated.[72]

There is a strong case for actions to reinvigorate of the E3 programme – improving it to raise minimum energy performance standards for key household appliances, while demonstrably reducing consumer energy costs (CER) and greenhouse gas emissions.

In lieu of federal standards, some states are taking matters into their own hands. The Victorian government has announced legislation that would require gas heaters in most rental properties, and gas hot water systems in nearly all properties, to be replaced with efficient electric alternatives at end-of-life.[73]

Standards – whether they are applied federally or through state legislation – provide an equitable approach for renters, as they would ensure that any replacement appliances installed in rental properties are efficient and electric.

Standards should be backed by effective market-based incentives

While there is a clear case for expanding standards to drive uptake of efficient electric appliances, there will still be upfront cost hurdles to negotiate.

Prior experience in Australia has shown that financial incentives have an important place in driving higher uptake of household energy upgrades, and helping to build industry capability for a future state when those upgrades are considered standard.

[71] IEEFA. Appliance standards are key to driving the transition to efficient electric homes. 23 April 2024. Page 7.
[72] IEEFA. Australia needs more efficient, smarter home hot water systems. 21 August 2024; IEEFA. Smart air conditioners could reduce energy bills for consumers. 22 October 2024.
[73] Premier of Victoria. Securing Victoria's Gas Supply While Slashing Energy Bills. 24 June 2025.

Research by the Grattan Institute found that market-based mechanisms were the most successful emission reduction policies in Australia. They identified that broad-based, outcome-focused programmes were more effective than those focused on narrow product-specific rebates.[74]

Both Victoria and New South Wales have had broad-based home energy upgrade incentive schemes since the 2000s.[75] More recently, focus has turned towards using these schemes to reduce peak electricity demand – via the New South Wales Peak Demand Reduction Scheme[76], and an ongoing review of the Victorian Energy Upgrades programme[77].

The Victorian Energy Upgrades scheme has recently been revised to provide more incentives for household electrification. These activities have rapidly become the most popular activity under the programme[78], with gas heating systems now being decommissioned at a rate that could see most gas ducted heaters replaced by the mid-2030s.[79]

Both schemes could be improved by expanding them to include a broader range of demand flexibility activities.

Federally, the SRES provides rebates for rooftop solar, heat pump hot water systems and more recently, batteries.

While the addition of battery rebates in the SRES is welcome, it is also a somewhat missed opportunity. Our modelling showed that additional household upgrades could play a significant role to complement or increase the impact of batteries – for example thermal efficiency upgrades, pre-heating and pre-cooling.

The SRES could provide much more value if it were expanded to incentivise a broader range of household energy upgrades that are known to reduce energy consumption, cut emissions and lower peak electricity demand.

The SRES is also due to expire in 2030, even though household energy upgrades are likely to remain one of the most cost-effective solutions to reduce household energy costs and emissions.

A broad-based federal incentive scheme for household energy upgrades is needed, and there are two obvious opportunities for the federal government to initiate this:

[74] Grattan Institute. Learning the hard way: Australia's policies to reduce emissions . April 2011. Page 3.
[75] While South Australia and the ACT also have energy savings schemes, these are not market-based.
[76] NSW Climate and Energy Action. Peak Demand Reduction Scheme. Accessed 23 June 2025.
[77] Victorian Department of Energy, Environment and Climate Action. Victorian Energy Upgrades Strategic Review: Discussion Paper. February 2025. Page 4.
[78] The Victorian Energy Upgrades data dashboard shows negligible certificates generated for heating and cooling upgrades in 2023, followed by 1.3 million in 2024, and 1.5 million in the first five months of 2025 (accessed 6 June 2025).
[79] Renew Economy. Decommissioning rates show gas heating could be gone by 2032, but oil exec bonuses might suffer. 2 June 2025.

1. Expand and extend the SRES to provide a broad-based incentive for measures that reduce household energy consumption and peak demand; or

2. Work with New South Wales and/or Victoria to expand their energy upgrade schemes to other states and territories.

There are multiple ways to fund incentive schemes, and this report does not seek to recommend a single approach. However, it is worth remembering that household energy upgrades represent a more valuable use of government funding than direct energy bill subsidies; and household energy upgrades can deliver benefits to all energy consumers.

Equity concerns are an understandable consideration when choosing a possible funding mechanism. In IEEFA's view, a top priority should be to ensure all consumers have access to household energy upgrades, including renters and those on low incomes. A standards-based approach will help towards this aim, and other organisations have provided targeted recommendations in this area. [80]

Either retailer-funded or government-funded schemes present various options to address social equity concerns – for example, by exempting consumers who receive energy concessions from the cost of these schemes.

Households should be better rewarded for reducing peak demand

Our modelling identified peak demand reduction as a key benefit of household energy upgrades. However, the rewards for providing these services are weak.

Households on a time-of-use tariff will benefit from using a battery to reduce their energy consumption in the evening, and will also have an incentive to import energy from the grid in the middle of the day. However, this benefit is modest relative to the actual wholesale value of electricity at those times of day.

Very few retailers offer a feed-in tariff that is higher in the evening period than the middle of the day. This means, after losses are considered, households lose money by exporting from their battery during the evening peak, despite this being valuable for the system as a whole.

While reforming electricity prices alone is unlikely to drive significant change, it is still essential that consumers have access to fair rewards for the services they are providing to the grid.

Improved pricing structures would provide opportunities for engaged consumers to configure their batteries to operate in ways that support the grid, or for more service providers to provide innovative solutions to automate this for consumers.

[80] For example, ACOSS. Funding and Financing Energy Performance and Climate-Resilient Retrofits for Low-income Housing. January 2024. Page 40.

VPPs have emerged as an appealing model to enable residential batteries to support the grid at scale, while imposing fewer burdens on their owners to actively manage the battery.

However, there is little transparency over how VPP operators typically utilise batteries. There is a risk that batteries are operated in a way that benefits the operator but not the consumer, and it is difficult for consumers to understand if they will receive a net benefit from signing up to a VPP.

More regulation may be needed to ensure consumers receive a net benefit from participating in VPPs, and that VPPs provide an appropriate level of value to the grid. This is particularly urgent now that New South Wales and Western Australia offer battery rebates that are conditional on households subscribing to a VPP.

Network cost regulation needs urgent review

Network costs comprise a significant portion of consumer energy costs. However, neither gas nor electricity network regulations in Australia were designed with the assumption that consumers would become less dependent on network assets in future.

Our modelling indicates that widespread uptake of household energy upgrades could significantly change the way households interact with gas and electricity networks.

For gas networks, the direction is unambiguous: it is overwhelmingly in the interests of households to shift to efficient electric appliances, and cease using the gas network entirely.

For electricity networks, the situation is more nuanced. Efficient electric households with solar and batteries will significantly reduce their day-to-day dependence on electricity networks. However, they may still draw on that network on days with high demand or low solar output. They may also rely on networks to import and export energy to and from their battery at key times.

These changes should be viewed as an opportunity. Shifting to efficient electric appliances will negate the need to build and maintain costly gas infrastructure, and CER can provide more cost-effective energy services to consumers than networks at many times of the day, and of the year.

Yet Australia's inflexible regulatory arrangements for energy networks may block these benefits from being passed through to consumers.

By default, consumers may be expected to pay the full cost to depreciate past energy network investments, regardless of whether they still derive value from those assets.[81] Defection from energy

[81] Note that while both electricity and regulated gas networks argue they are entitled to full cost-recovery, there is no such explicit guarantee under gas network regulation. (Justice and Equity Centre. Jemena Gas Networks access arrangement 2025-30: Issues paper. 20 September 2024. Page 14.)

networks could also lead to escalating prices being passed on to the networks' remaining consumers.

This is a very imminent concern for gas networks, given the high forecast levels of household electrification.[82] It may also lead to significant equity concerns for households that are unable to leave the gas network, such as renters.

For electricity networks, the effect may be somewhat countered by the addition of electrified gas loads and EVs.[83] However, it is clear that household energy upgrades present an opportunity to use electricity network assets more efficiently, which should be rewarded.

Adding to the need to review network regulations, past IEEFA analysis has identified that regulated electricity and gas networks have consistently earned returns that far exceed the target rate set by the regulator, and are more reflective of risk-exposed businesses.[84]

Previous IEEFA analysis has also identified the future contestability between services offered by CER and distribution networks as one of a broad range of issues that warrant a "first-principles review of the economic regulation of distribution networks, which would identify ways to ensure efficient costs of network services in a high-DER [distributed energy resources] world".[85]

Such a review should be undertaken by an independent body with expertise in both network regulation and CER.

Conclusion and recommendations

It is difficult to envision a solution to reduce household energy bills that would be as effective as upgrading to efficient electric appliances, installing rooftop solar and installing household batteries.

It is even more difficult to envision a solution that simultaneously frees up gas demand for higher-value uses, and reduces or provides options to manage peak electricity demand.

In some regions, transitioning from gas to efficient electric appliances will create new challenges as winter peak demand increases. However, those challenges are outweighed by the significant savings from reducing dependence on fossil gas, and can be effectively managed through deployment of other household energy upgrades – such as batteries and pre-heating.

[82] AEMO. 2025 Gas Statement of Opportunities. March 2025. Page 5.
[83] CSIRO. Consumer impacts of the energy transition: modelling report. July 2023. Page 19.
[84] IEEFA. Power prices can be fairer and more affordable. 22 November 2023; and IEEFA. Gas networks are making persistent and significant supernormal profits. 6 June 2024.
[85] IEEFA. Reforming the economic regulation of Australian electricity distribution networks. 31 May 2024. Page 4.

There is also a significant untapped opportunity to reduce costs and peak demand impacts by transitioning inefficient electric appliances to efficient alternatives.

Homes that are more thermally efficient have lower costs to run overall, will gain greater value from rooftop solar and batteries, and have the ability to engage in lower-cost peak demand reduction methods such as pre-heating and pre-cooling.

Many household energy upgrades are cost-effective today. However, it will be critical for consumers to be fairly compensated for their contribution to reducing peak demand.

Decision-makers must consider the barriers that have historically blocked households from taking up cost-effective energy upgrades, and past experience of policies that have proved to be successful. A combination of improved standards for household appliances, and comprehensive, consistent rebate schemes are likely to drive much higher uptake of the upgrades discussed in this report.

Recommendations

1. **Federal and state governments should commit to halve household energy bills over the next decade.**

   This should be based on a roadmap to rollout the technologies discussed in this report, accompanied by a policy pathway to deliver them.

2. **Minimum energy performance standards should be expanded and increased** to discourage installation of gas or inefficient electric appliances, and encourage installation of efficient and flexible electric appliances.

3. **A comprehensive, national incentive scheme for energy upgrades should be implemented.**

   This could involve expanding the Victorian and/or New South Wales incentive schemes nation-wide, or by expanding and extending the federal Small-Scale Renewable Energy Scheme.

   The scheme should support demand flexibility measures, extend beyond 2030, and consider the wide range of equitable funding approaches.

4. **Fairer electricity pricing structures should be provided for consumers that offer reasonable rewards for efforts to reduce peak demand.**

   This should include improved tariffs, and well-designed, well-regulated Virtual Power Plants that support the interests of consumers and the grid. This should be considered as central to the Australian Energy Market Commission’s ongoing electricity pricing review.

5. **A first-principles review of the economic regulation of gas and electricity networks should be undertaken.**

   This should be led by an independent panel with expertise in economic regulation, competition policy and consumer energy resources.

   The review should re-evaluate the cost recovery approach for energy networks to fairly reflect the diminishing value of some assets (such as the gas distribution network asset base), while providing the right incentives to support wider uptake of consumer energy resources.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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