Australia's Evolving Energy Consumer

AEMC Perspectives Piece

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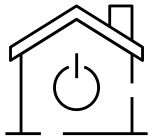
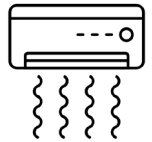
Executive summary

Key takeaways

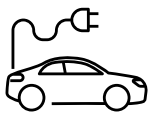


Appliance and vehicle electrification lower a household's energy consumption, which reduces its energy expenditure.

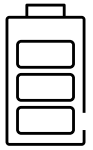


Space heating and water heating electrification have relatively fast paybacks in Canberra and Melbourne, driven by high heating demand and larger subsidies.

Cooking electrification can be economic if it enables gas disconnection and associated gas supply charge savings.



Vehicle electrification pays for itself relatively quickly in Melbourne and Hobart, and relatively slowly in Adelaide and Sydney.



Solar battery installation pays for itself relatively quickly in Adelaide and Sydney, where electricity prices are highest.

Payback periods are faster as the number of occupants in a household increases but are slower as a household's thermal efficiency increases.

This perspectives piece examines the economics of residential electrification in Australia. That is, it analyses the costs, benefits, and payback periods associated with replacing gas and petrol technologies with efficient electric alternatives and installing Consumer Energy Resources (CER) including rooftop solar and battery systems.

We use a detailed techno-economic model, developed for the AEMC's Residential Electricity Price Trends report, to analyse household energy use and technology adoption decisions across different locations and energy requirements.

- **Section 1** documents the current state of electric technology adoption, highlighting rapid growth in rooftop solar, heat pump water heaters, batteries, and electric vehicles.
- **Section 2** analyses the key drivers of residential electrification, showing how large energy efficiency gains from electric technologies substantially reduce a household's total energy consumption, and how solar and battery systems can enable high levels of self-consumption and export revenue.
- **Section 3** examines why payback periods vary across regions, explaining these differences in terms of climate, energy prices, and subsidies.
- **Section 4** compares paybacks across household sizes and dwelling thermal efficiency.

Electrification and solar and battery investments can deliver substantial cost savings, but their financial attractiveness differs markedly by city. In general, lower electricity prices support appliance and vehicle electrification, while higher electricity prices accelerate paybacks for solar and battery installations.

Uptake of electric technologies by consumers has been rapid

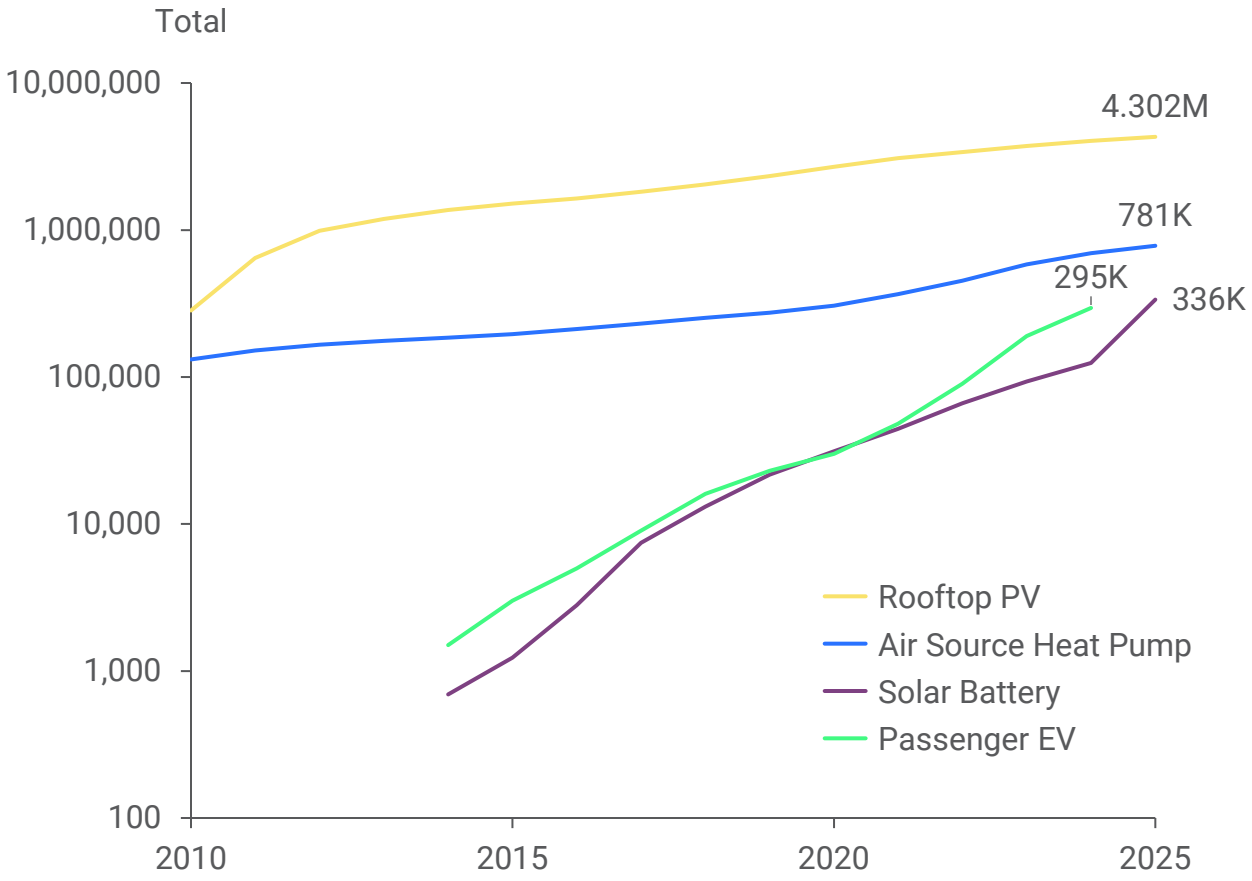
The introduction of energy-efficient electric appliances and vehicles, rooftop photovoltaic panels, and home batteries has enabled Australians to enjoy the energy services they have become accustomed to using less purchased energy.

As the figure to the right shows, hundreds of thousands of households have already embraced these technologies.

In the 5 years to December 2025, installations of rooftop PV systems increased by 60%, heat pump hot water systems by 155%, and solar battery systems by 948%. In the 5 years to June 2025, passenger EVs on the road grew by almost 1,300%.

Uptake of electric technologies by consumers

Australia-wide; Logarithmic scale



Sources: Clean Energy Regulator (2026) *Small-scale installation postcode data*; Electric Vehicle Council (2025) *State of Electric Vehicles 2025*; AEMC analysis.

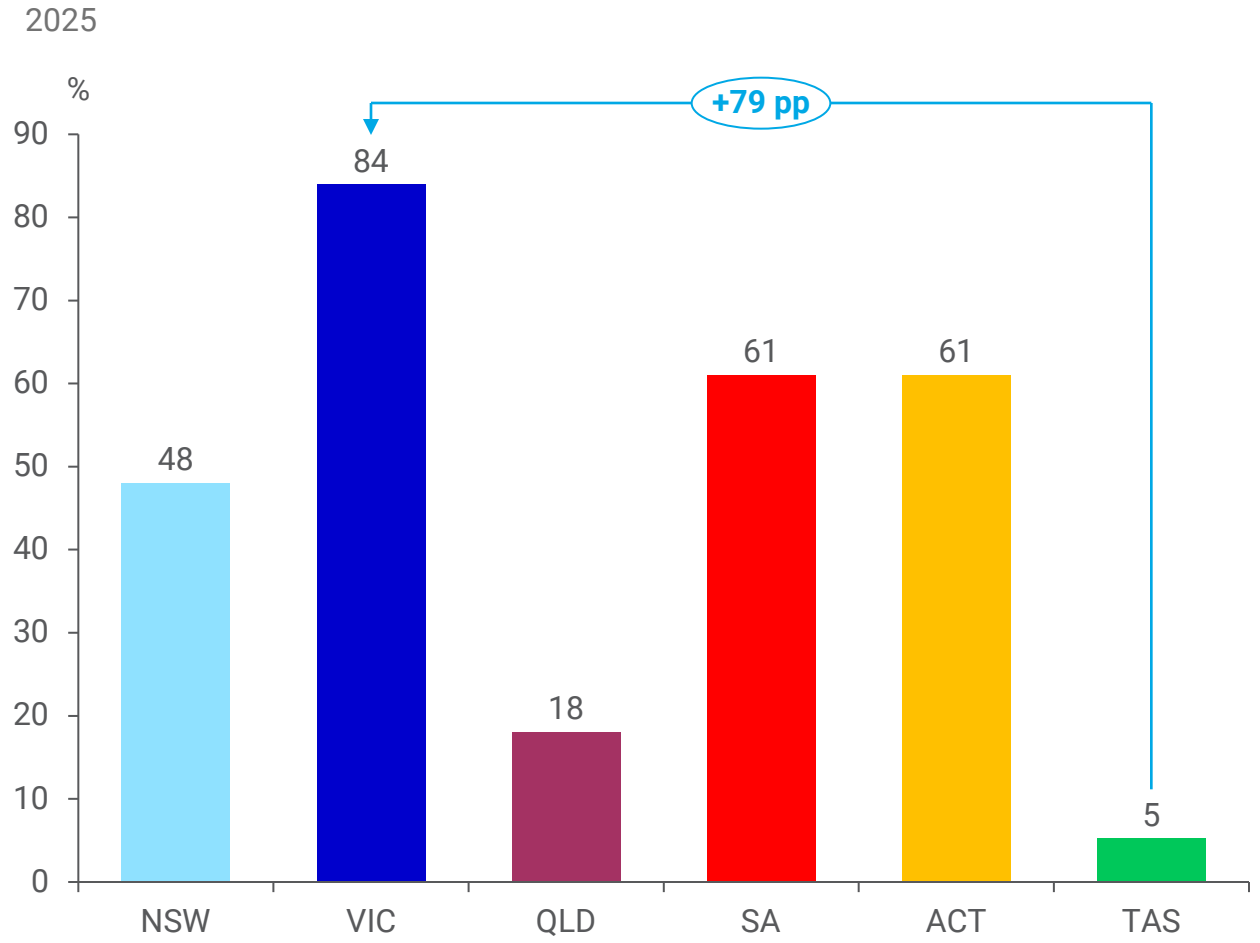
Victoria has the highest proportion of households with a gas connection, while Tasmania has the lowest

While we model gas switching across all NEM regions, it should be noted that only around 18% of households in Queensland, and around 5% in Tasmania, have a gas connection, as shown in the figure to the right.

This contrasts with other states and territories where gas connections are much more common. For example, in Victoria, currently around 84% of households are connected to a gas network[1].

Therefore, our analysis of space, water, cooktop and oven heating electrification, and gas network disconnection, is primarily relevant to households in Victoria, South Australia, ACT and NSW, and to a much lesser extent to households in Queensland and Tasmania.

Proportion of households with mains gas, by state and territory



Notes: 1. Policy settings also differ across jurisdictions. Some jurisdictions are seeking to regulate or limit uptake of new gas connections – most notably the ACT and Victoria.

Sources: Energy Consumers Australia (2025) *How households use gas and their attitudes towards electrification*; Elgas (2025) *Australian Natural Gas Statistics*; Australian Bureau of Statistics (2021) Census of Population and Housing; AEMC analysis.

Electric technologies use up to 80% less energy than gas and petrol counterparts

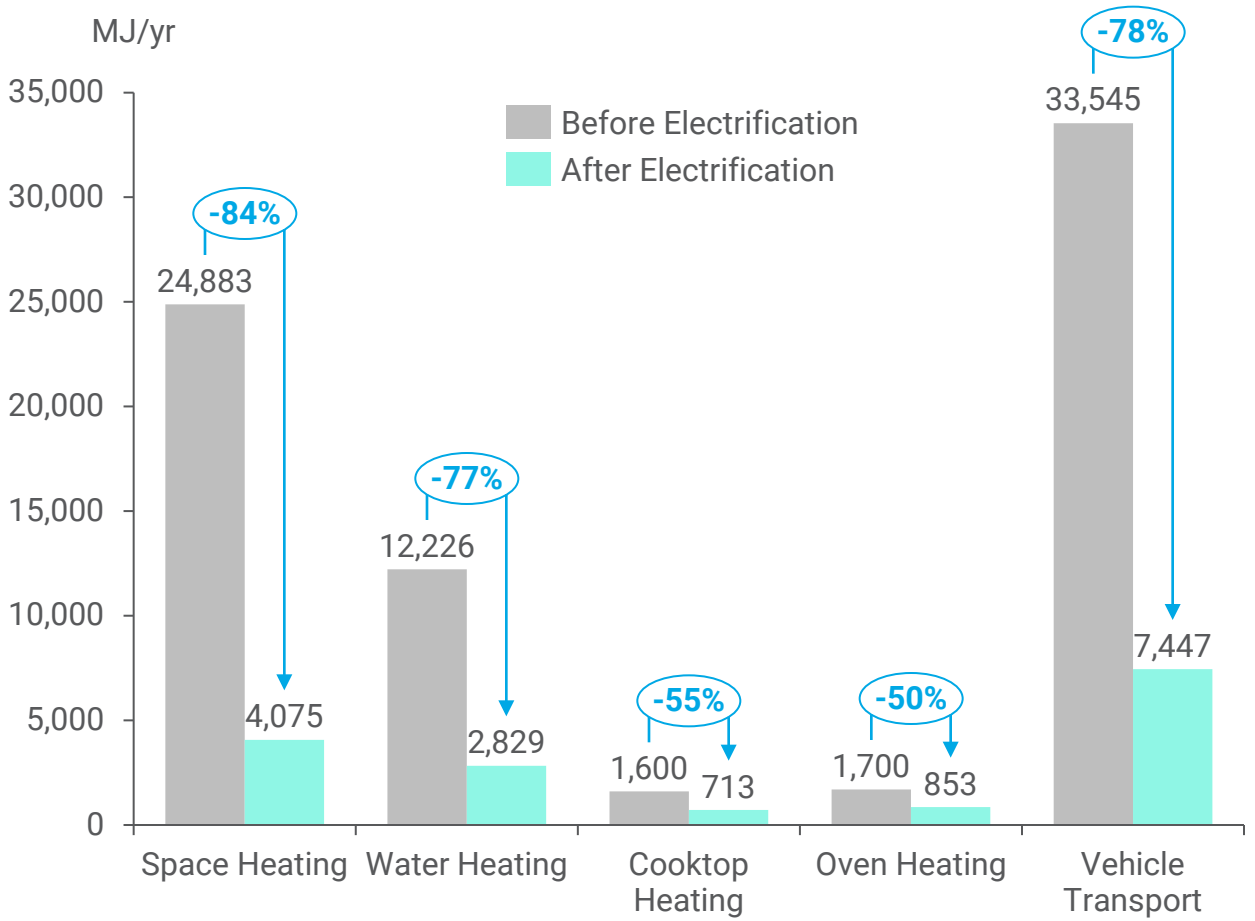
The figure shows that, when a household electrifies, it can enjoy the same energy output using between 50% and 84% less energy input.

Electric technologies are usually more energy efficient than gas and petrol counterparts. For example,

- A reverse cycle air conditioner (RCAC) can be about **7 times** more energy efficient than a typical (3-star) gas ducted heater. While this gas heater has an efficiency of around 60%[1], an RCAC can have an efficiency of around 400%.
- A heat pump hot water system can be about **4 times** more energy efficient than a typical (5-star) gas instantaneous hot water system. While this gas hot water system has an efficiency of around 65%, a heat pump hot water system can have an efficiency of around 280%.
- An electric vehicle (EV) can be about **4-5 times** more energy efficient than an internal combustion engine vehicle (ICEV). While a new mid-sized ICEV can have a fuel efficiency of around 8L/100km, an EV can have an efficiency of around 16kWh/100km, which is equivalent to 1.8L/100km.

Household energy use, by energy service and stage of electrification

3-person house; 3-star thermal rating; Average across NEM capital cities



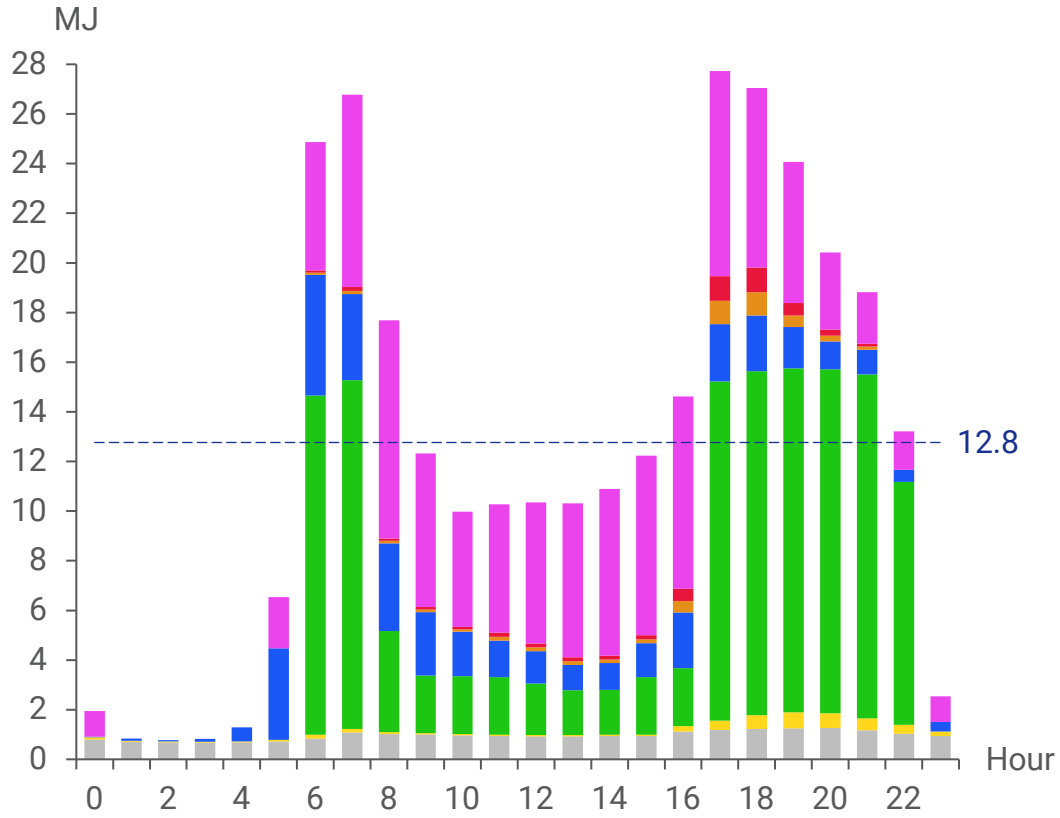
Sources: AEMC Residential Energy Consumer Model.

Notes: 1. The energy efficiency of a heating technology is often referred to as its 'Coefficient of Performance (COP)', which measures how efficiently it converts input energy into heat energy.

Electrification can significantly reduce a household's energy consumption

Hourly energy use before electrification, by energy service

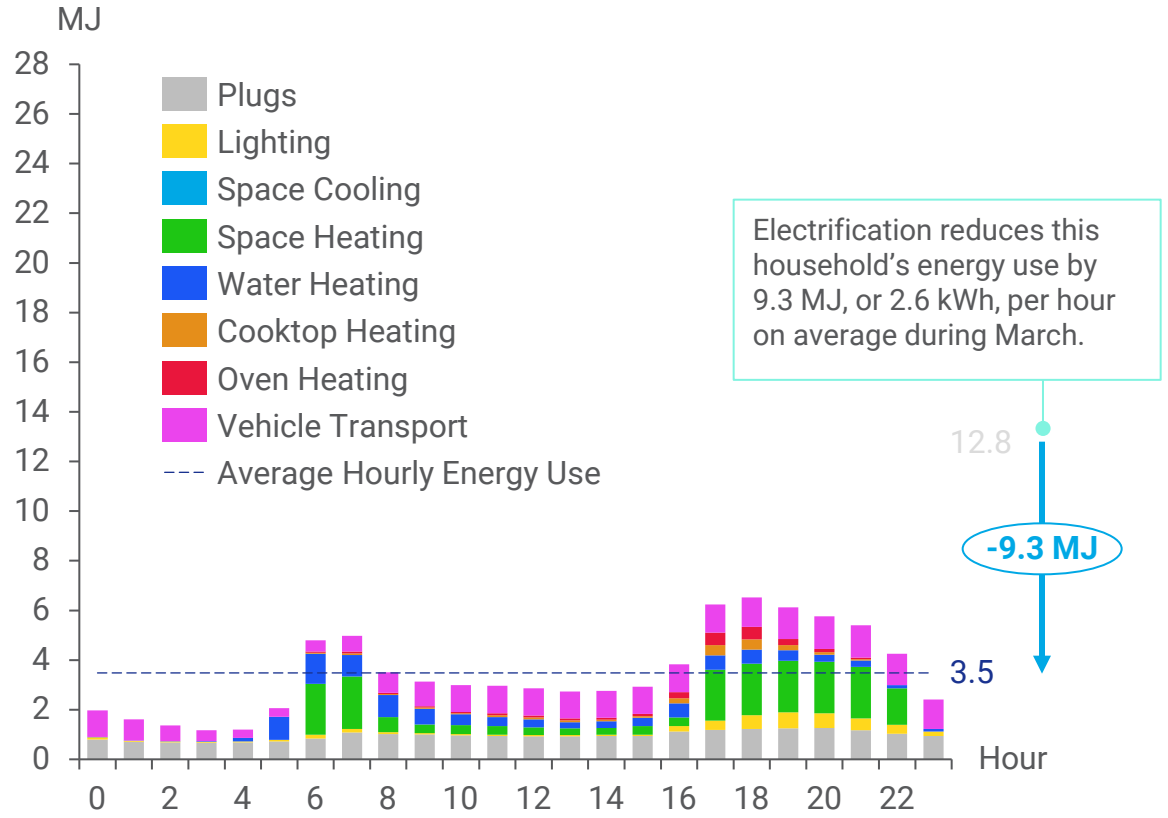
3-person house; 3-star thermal rating; Gas-powered appliances; Petrol vehicle; Average day in March; Melbourne



We captured 8 different energy sub-loads and summed them to form a household's gross energy load.

Hourly energy use after electrification, by energy service

3-person house; 3-star thermal rating; Efficient electric-powered appliances; Electric vehicle; Average day in March; Melbourne



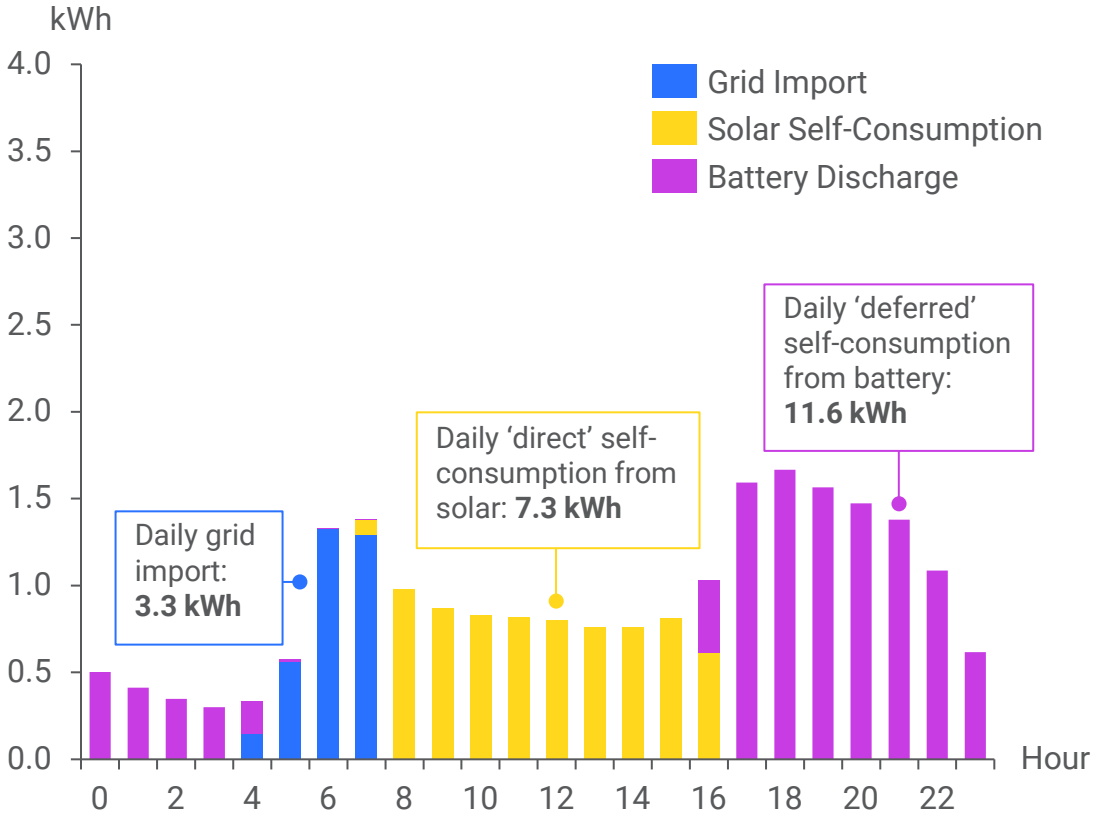
Efficient electric assets deliver the same energy services using a fraction of the energy used by inefficient gas and petrol assets.

Notes: The shape of the vehicle transport sub-load before electrification is illustrative only and does not impact results.
Sources: AEMC Residential Energy Consumer Model.

Installing a solar battery allows a household to further reduce its energy purchases

Hourly electricity consumption, by source

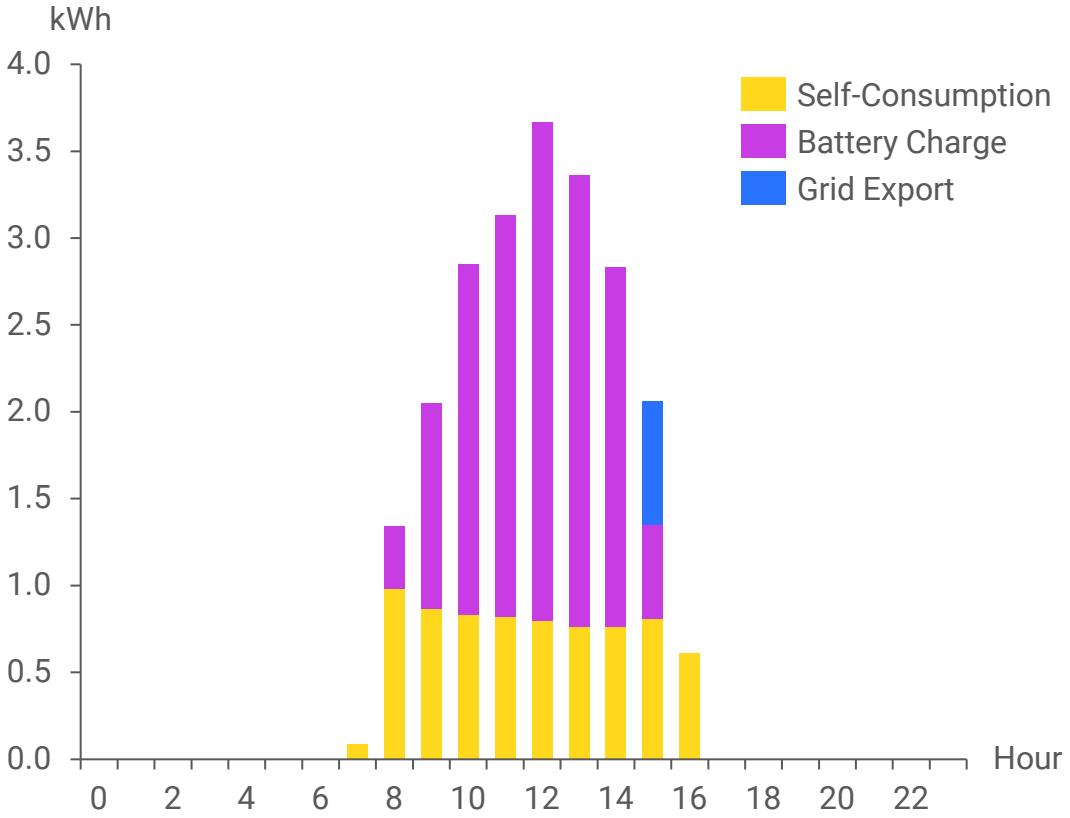
3-person house; 3-star thermal rating; Appliances and vehicle electrified; 10kW/20kWh solar battery installed; Average day in March; Melbourne



This household can source electricity from its rooftop solar system, battery, or the grid. The first two sources are free.

Hourly solar generation, by recipient

3-person house; 3-star thermal rating; Appliances and vehicle electrified; 10kW/20kWh solar battery installed; Average day in March; Melbourne



A household's solar generation can be consumed directly, stored in its battery, exported to the grid, or curtailed if export limits are met.

Notes: This household's battery is modelled to follow a simple 'solar soaking' pattern.
Sources: AEMC Residential Energy Consumer Model.

We modelled the economics of 8 actions for various households across Australia

Schedule of upfront purchases and sales experienced by an evolving energy consumer

Prices are in FY26 $AU and include GST

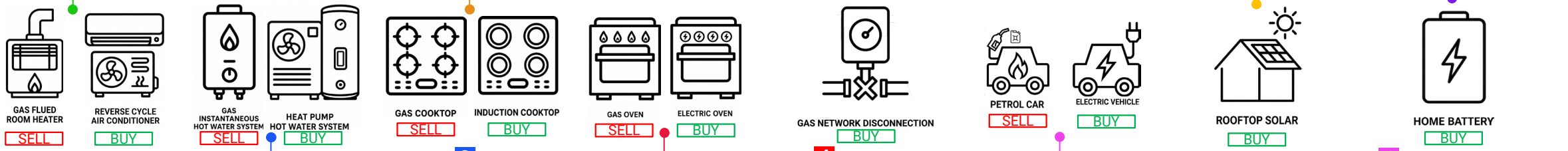
1 We modelled **space heating electrification** as the replacement of a flued gas space heater with a COP of 70% and resale value of $360 with a 7kW RCAC with a COP of 410%-502% selling for $2.2K, costing $800 to install, and eligible for up to $1.7K of subsidies.

3 We modelled **cooktop electrification** as the replacement of a gas cooktop with a COP of 40% and resale value of $60 with an electric induction cooktop with a COP of 85% selling for $940, costing $300 to install, and eligible for up to $170 of subsidies.

5 We assumed **disconnecting from a gas network** costs $200 in all cities.

7 We modelled a 10kW **rooftop solar** system selling for $10.3K, costing $2K to install, and eligible for $2.7K-$3.7K of subsidies.

8 We modelled a 20kWh **battery** system selling for $15.8K, costing $2K to install, and eligible for $6.6K of subsidies.



2 We modelled **water heating electrification** as the replacement of a gas instantaneous hot water system with a COP of 70% and resale value of $150 with a heat pump hot water system with a COP of 447%-546% selling for $3.7K, costing $1.2K to install, and eligible for $0.5K-$2.0K of subsidies.

4 We modelled **oven electrification** as the replacement of a gas oven with a COP of 40% and resale value of $100 with an electric oven with a COP of 74% selling for $730 and costing $300 to install.

6 We modelled **vehicle electrification** as the replacement of a mid-sized petrol car with a fuel efficiency of 8L/100km and resale value of $20K with a mid-sized battery electric vehicle with fuel efficiency of 15kWh/100km selling for $40K that is charged according to AEMO's 'unscheduled' profile.

Space Heating Electrification | **Water Heating Electrification** | **Cooktop Electrification** | **Oven Electrification** | **Gas Disconnection** | **Vehicle Electrification** | **Solar Installation** | **Battery Installation**

Notes: We assumed electricity prices are averages of major retailer time-of-use standing offers. Except where noted, we modelled standalone actions, rather than combinations of actions.
Sources: AEMC analysis.

Payback periods for electrification tend to be faster in colder climates, while those for solar battery installation tend to be faster in warmer climates

For the 8 electrification actions studied, we answer two questions:

1. How do payback periods vary across regions?
2. Why are payback periods faster in some regions than others?

To answer the first question, we calibrated the payback calculation outlined in the Appendix using location-specific inputs.

The chart to the right shows that payback periods for space heating, water heating and vehicle electrification are fastest in **Melbourne**, while that for solar battery installation is fastest in **Adelaide**.

Moreover, fully electrifying and installing a solar battery all at once pays for itself fastest in **Canberra**.

Payback periods, by action and city

Years; 5% discount rate; 3-person house; 3-star thermal rating; 10kW solar; 20kWh battery

Relatively slow — Relatively fast

City	Space Heating Electrification	Water Heating Electrification	Vehicle Electrification	Solar Battery Installation	Full Electrification + Solar Battery Installation
SYD	13.7	19.5	22.4	4.3	7.6
MEL	0.8	10.5	14.6	8.5	7.5
BNE	20.0	14.1	16.9	5.1	9.0
ADL	3.7	13.0	27.3	4.2	7.0
CBR	0.8	10.7	18.3	5.6	6.6
HOB	1.3	11.5	16.5	11.2	8.6

Notes: Solar battery installation is undertaken after full electrification, which includes space, water, cooktop and oven heating electrification, gas disconnection, and vehicle electrification.
Sources: AEMC Residential Energy Consumer Model.

We used Shapley decompositions to attribute regional differences in payback periods to regional differences in policies, energy prices, and climates

To answer the second question, we applied Shapley decompositions[1] to determine the extent to which location-specific factors, including policies, energy prices and climates, prolong or shorten a region's payback period relative to that of other regions.

The chart to the right shows that space heating electrification pays for itself 1.2 years faster in Melbourne than in the average NEM capital city[2].

Relative to the average NEM capital city, space heating electrification payback in Melbourne is shortened by

- 1.1 years due to generous subsidies,
- 0.4 years due to high space heating demand,
- 0.2 years due to low electricity usage rates,

and prolonged by

- 0.4 years due to low gas usage rates, and
- 0.1 years due to a low reverse cycle air-conditioner (RCAC) coefficient of performance (COP).

Notes: 1. A Shapley decomposition is a method that attributes the difference in an outcome between groups to individual drivers in a way that accounts for interactions between those drivers, by averaging their marginal contributions across all possible orderings. 2. The average NEM capital city is modelled to have attributes (e.g., energy prices, subsidies, PV generation) that are the average of those across NEM capital cities. Payback periods experienced in this NEM average capital city do not necessarily equal average payback periods across NEM capital cities, as payback functions are non-linear.

Regional differences in space heating electrification payback periods

5% discount rate; 3-person house; 3-star thermal rating

Decelerate — Accelerate

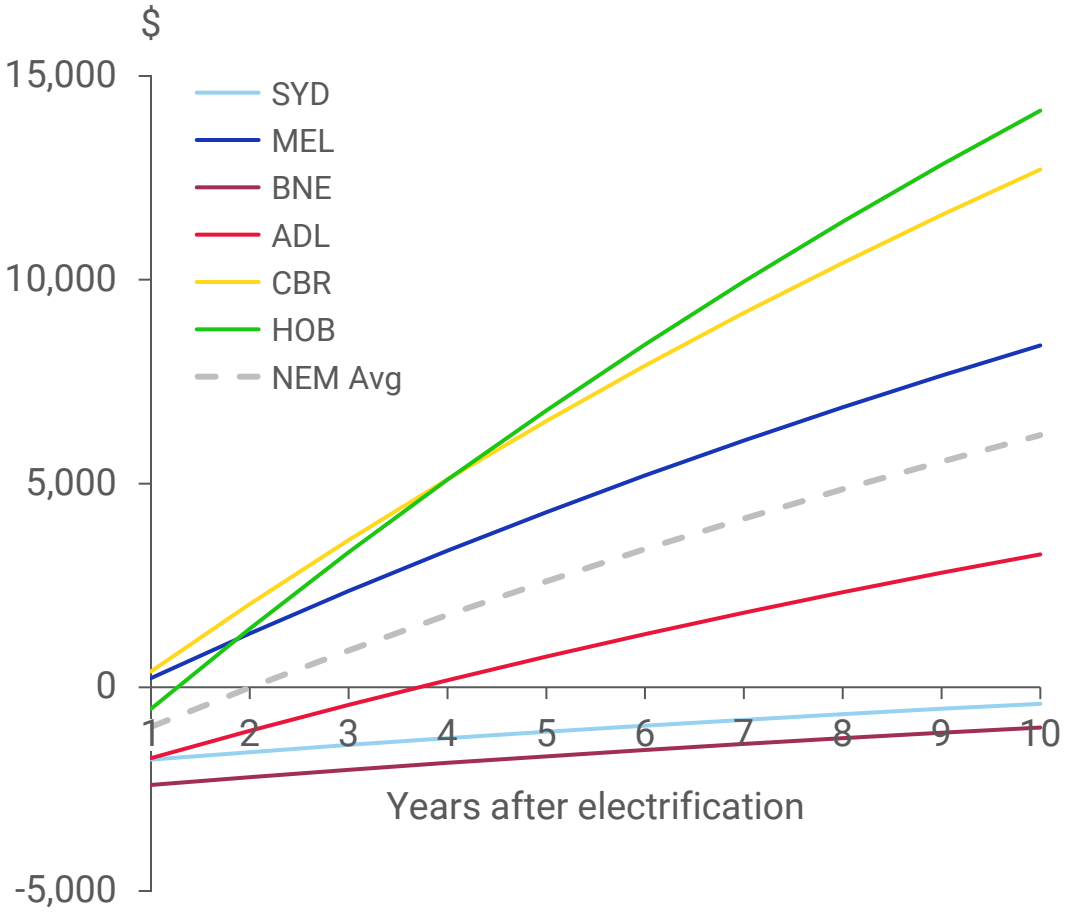
City	Payback Period	Payback Period Relative to NEM Average	Contribution to Relative Payback				
			Subsidies	Gas Usage Rate	Electricity Usage Rate	Space Heating Demand	RCAC COP
SYD	13.7	11.7	-0.1	0.5	1.3	10.2	-0.3
MEL	0.8	-1.2	-1.1	0.4	-0.2	-0.4	0.1
BNE	20.0	18.0	4.1	-1.4	0.1	16.1	-0.9
ADL	3.7	1.7	0.6	-0.5	0.4	1.2	-0.1
CBR	0.8	-1.2	-0.5	0.1	0.0	-0.9	0.1
HOB	1.3	-0.7	0.5	-0.2	-0.2	-0.9	0.1
NEM	2.0	0.0					

Sources: AEMC Residential Energy Consumer Model.

Space heating electrification pays for itself fastest in Canberra and Melbourne

Cumulative net cost saving due to space heating electrification, by city

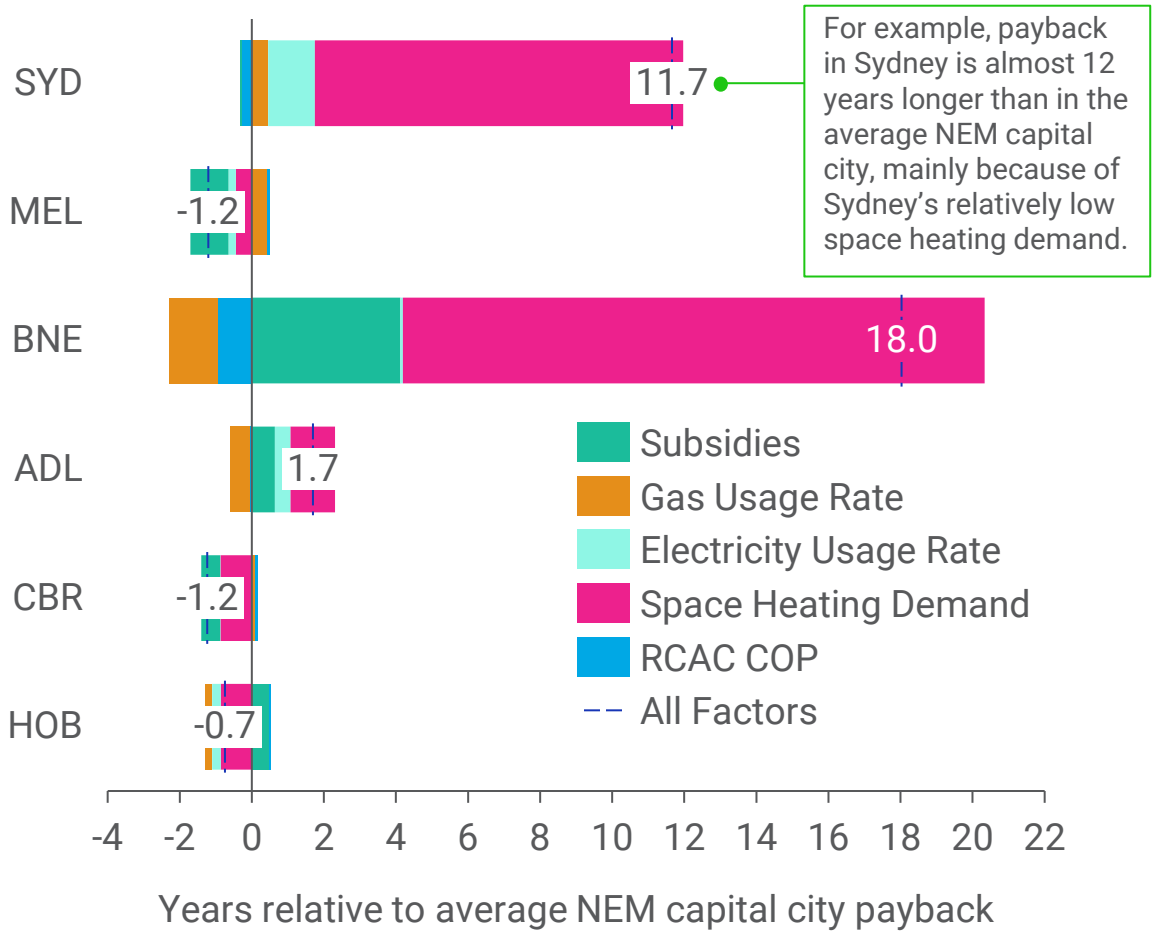
2026 $AU; Present values; 5% discount rate; 3-person house; 3-star thermal rating



Space heating demand and subsidies are the main drivers of payback periods

Space heating electrification payback compared to average NEM capital city payback

Shapley decomposition; Payback in average NEM capital city is 2.0 years

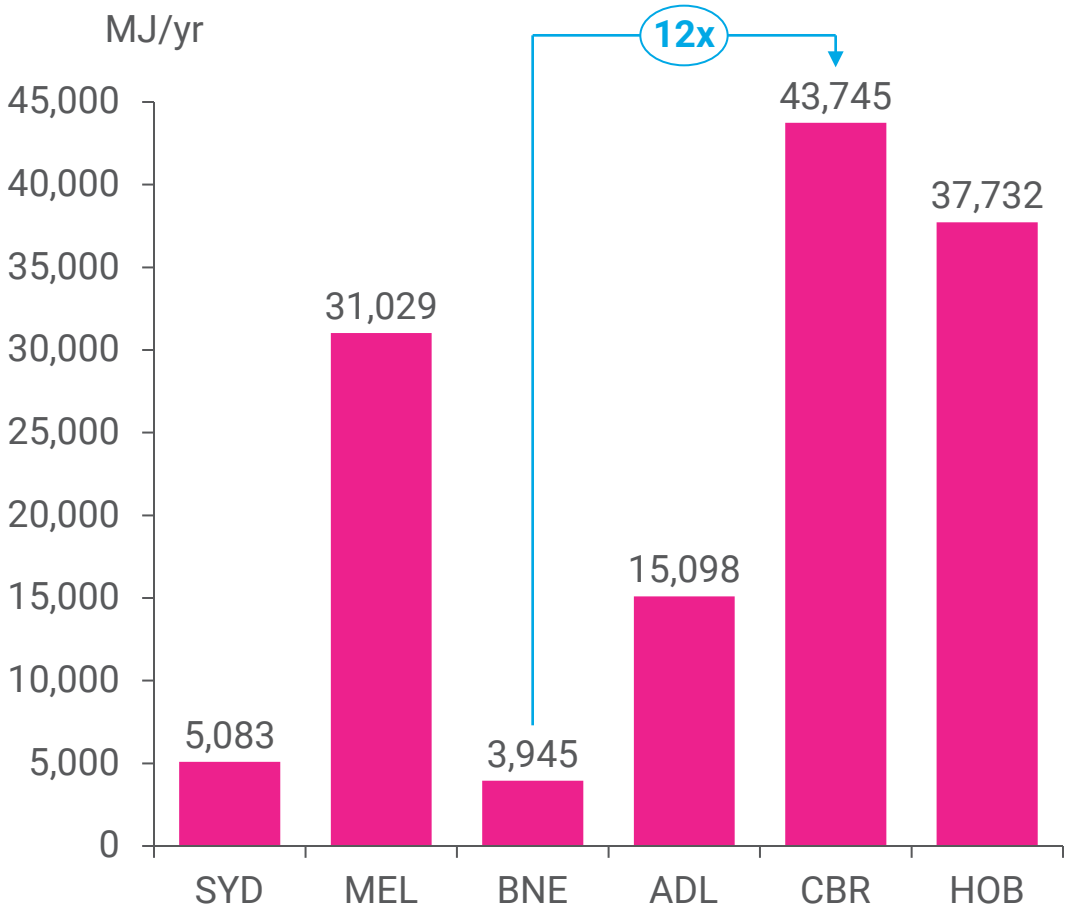


Sources: AEMC Residential Energy Consumer Model.

Annual space heating demand is 12 times higher in Canberra than it is in Brisbane

Annual space heating demand, by city

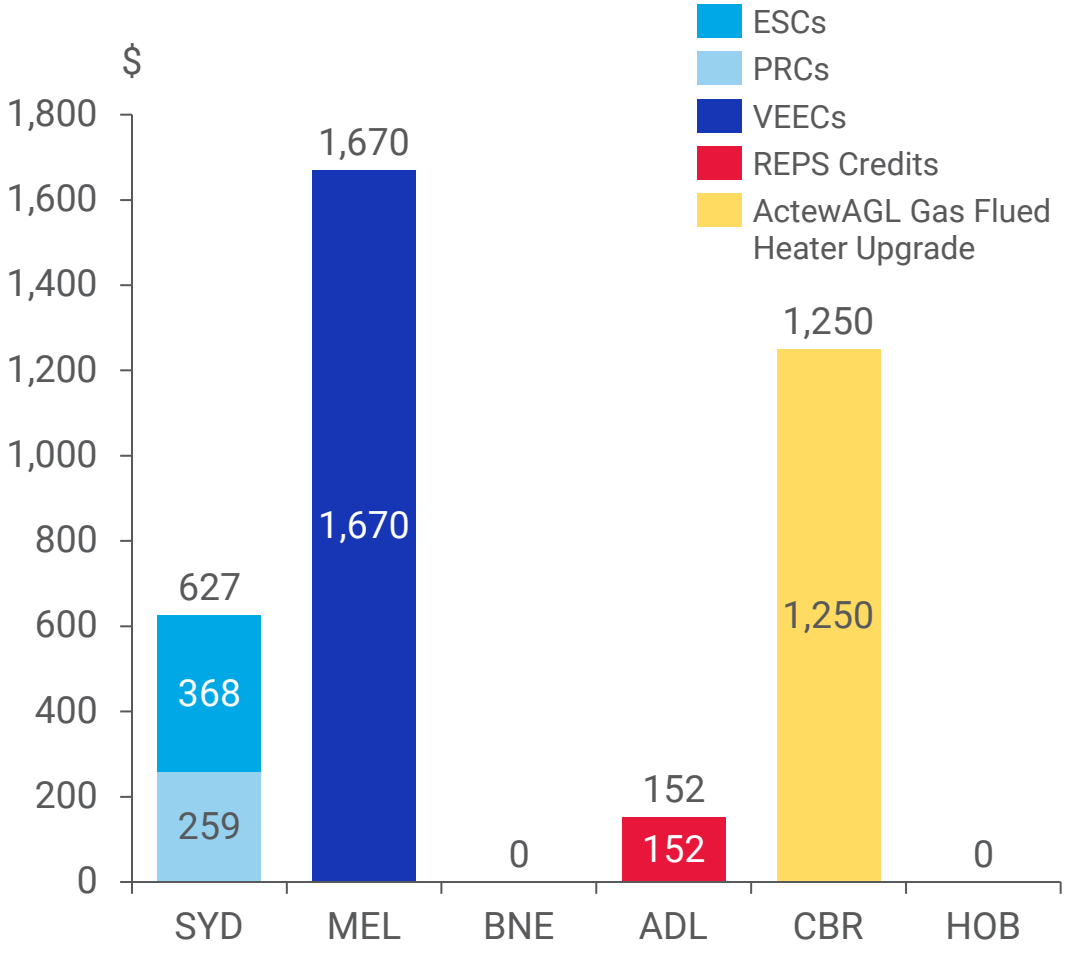
Heat energy added to rooms; 3-person house; 3-star thermal rating



Subsidies for space heating electrification are highest in Melbourne and Canberra

Subsidies for space heating electrification, by city

2026 $AU

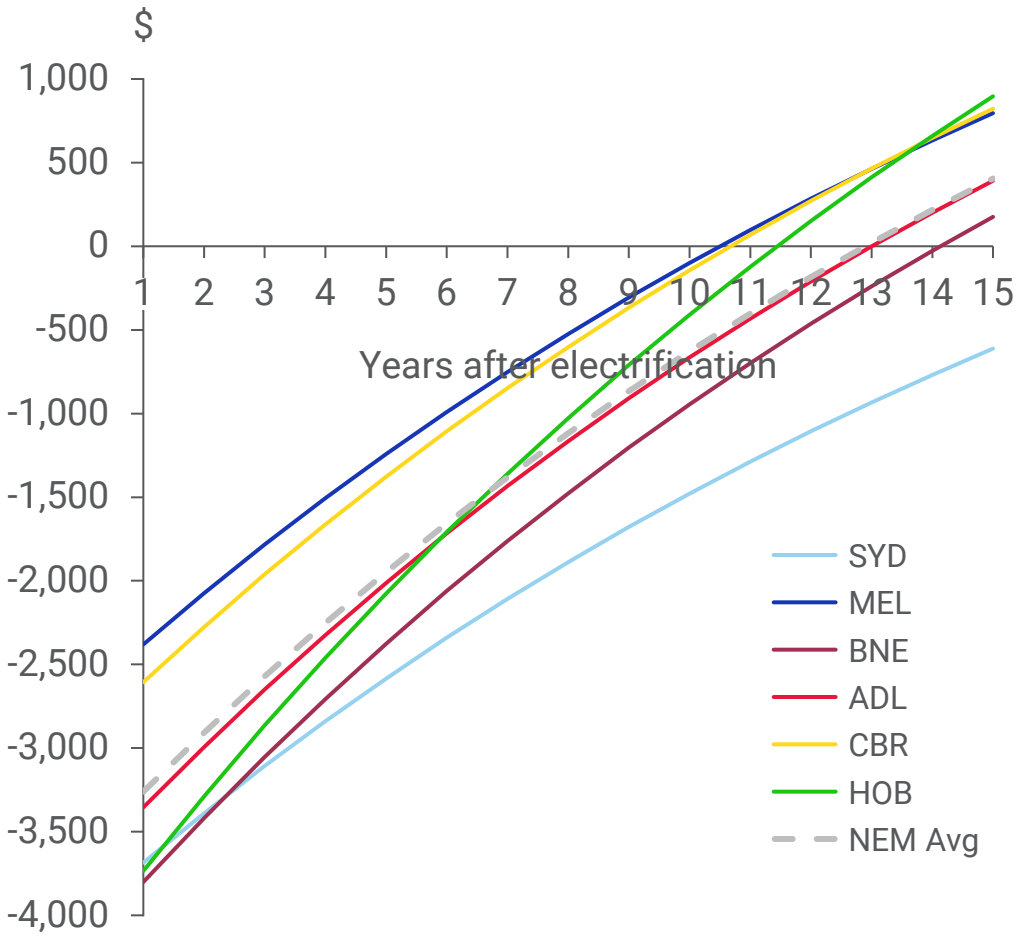


Notes: We have assumed that households in Canberra are customers of ActewAGL and are eligible for the Gas Flued Heater Upgrade discount worth $1,250. ESC stands for Energy Savings Certificate; PRC stands for Peak Reduction Certificate; VEEC stands for Victorian Energy Efficiency Certificate; REPS stands for Retailer Energy Productivity Scheme.
Sources: AEMC Residential Energy Consumer Model.

Water heating electrification pays for itself fastest in Melbourne and Canberra

Cumulative net cost saving due to water heating electrification, by city

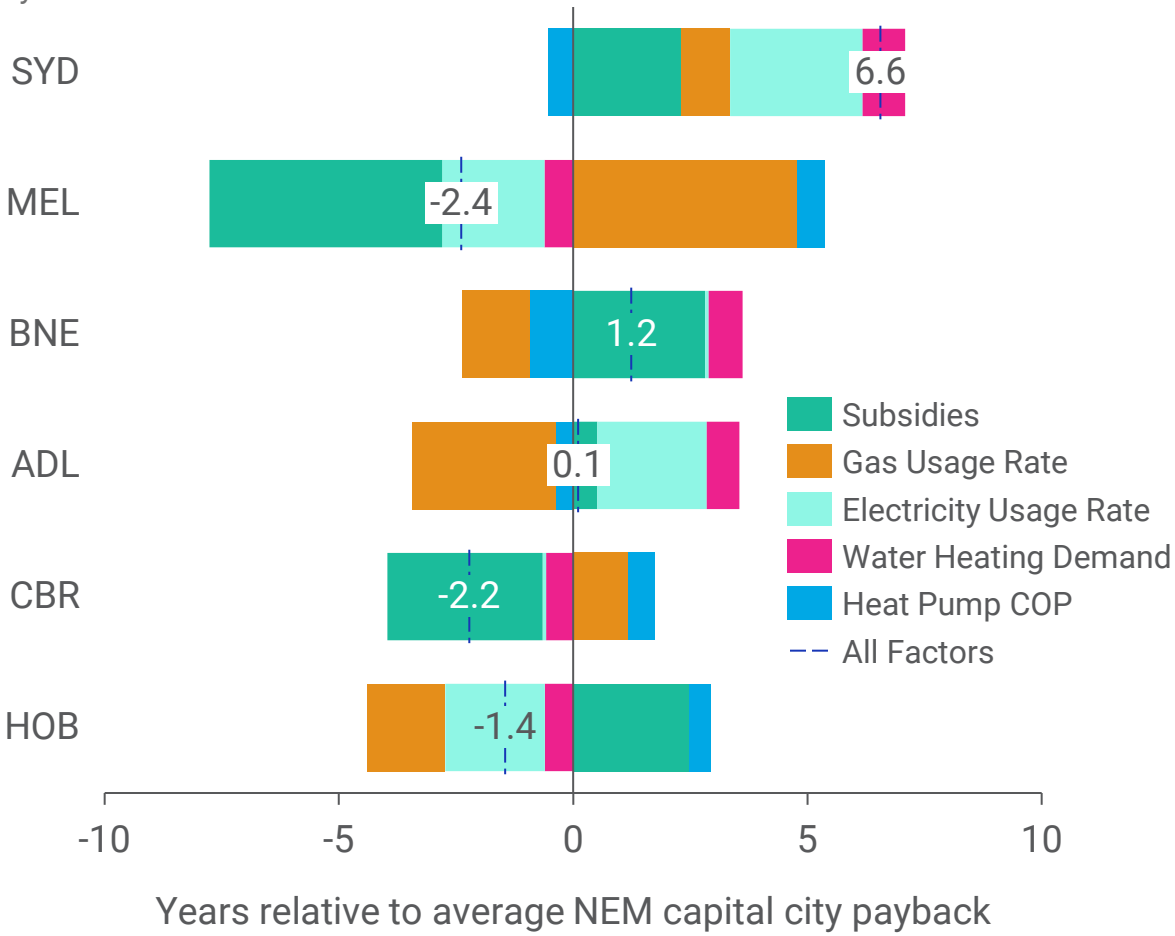
FY26 $AU; Present values; 5% discount rate; 3-person house



Subsidies and energy prices are the main drivers of payback periods

Water heating electrification payback compared to average NEM capital city payback

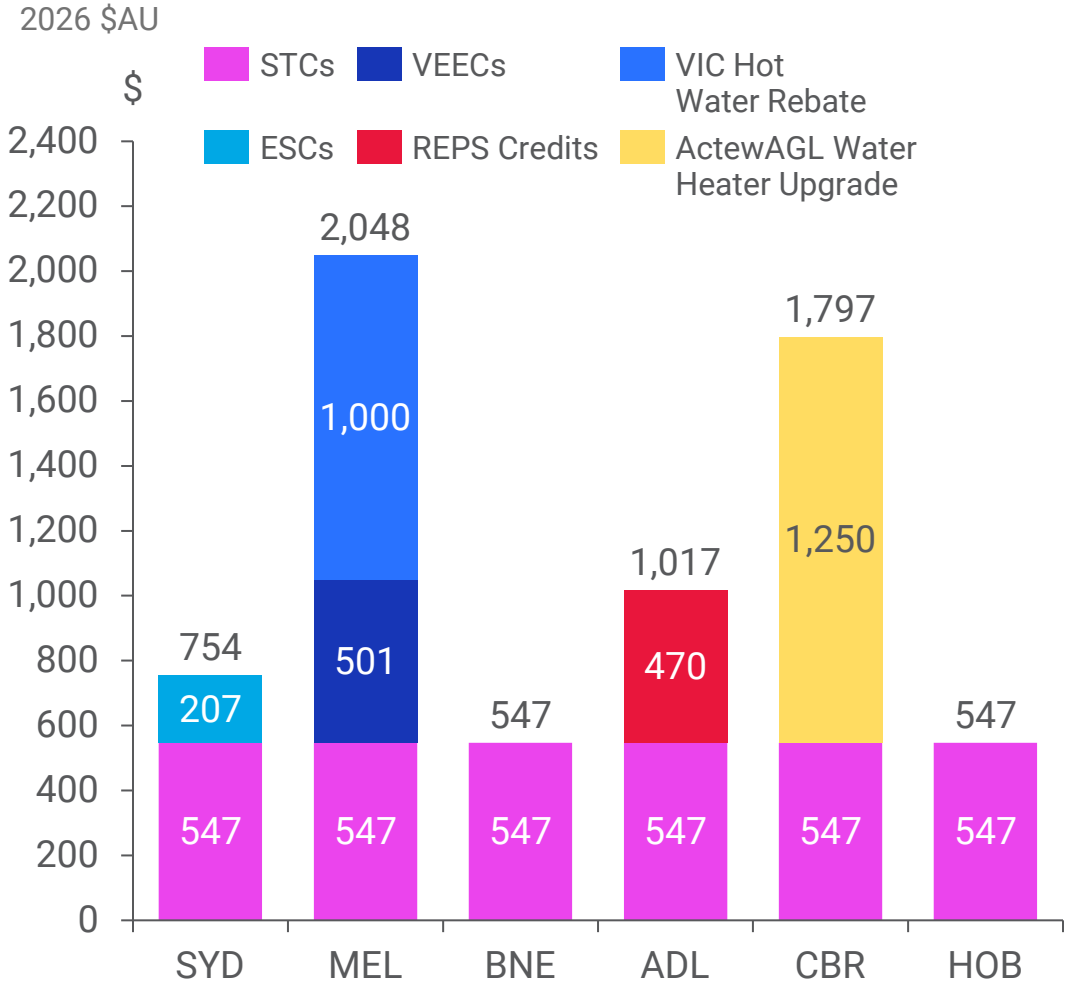
Shapley decomposition; Payback in average NEM capital city is 12.9 years



Sources: AEMC Residential Energy Consumer Model.

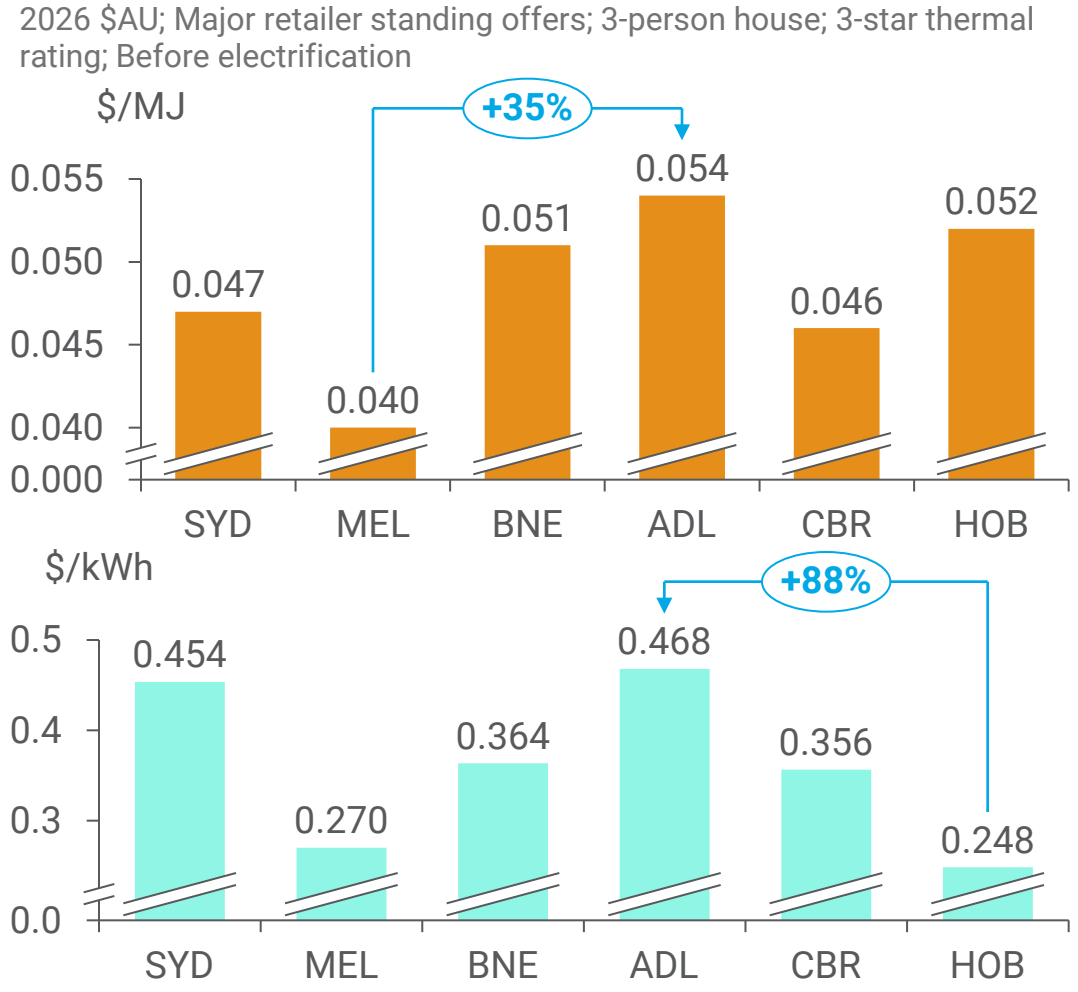
Subsidies for water heating electrification are highest in Melbourne and Canberra

Subsidies for water heating electrification, by city



Retail gas and electricity usage rates are highest in Adelaide

Volume-weighted average retail gas and electricity usage rates, by city

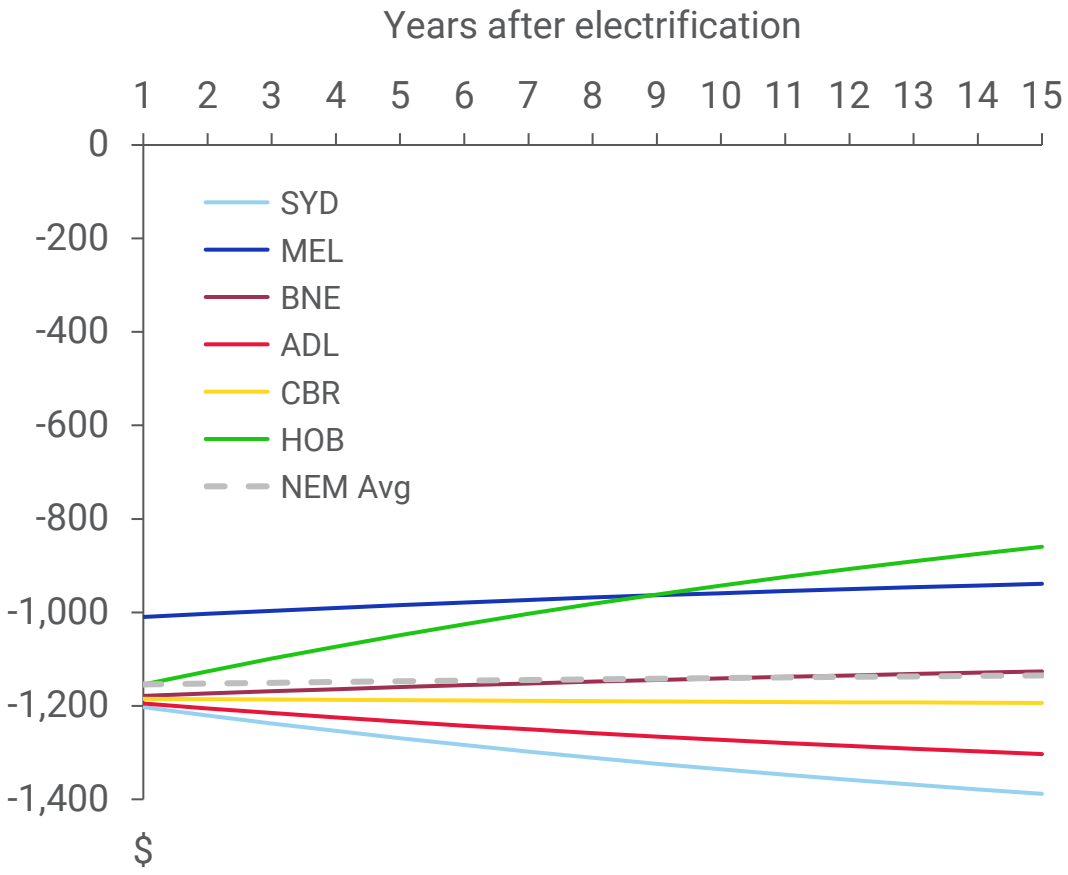


Notes: We have assumed that households in Canberra are customers of ActewAGL and are eligible for the Water Heater Upgrade discount worth $1,250. STC stands for Small-scale Technology Certificate.
Sources: AEMC Residential Energy Consumer Model.

Cooking electrification does not pay for itself as a stand-alone action

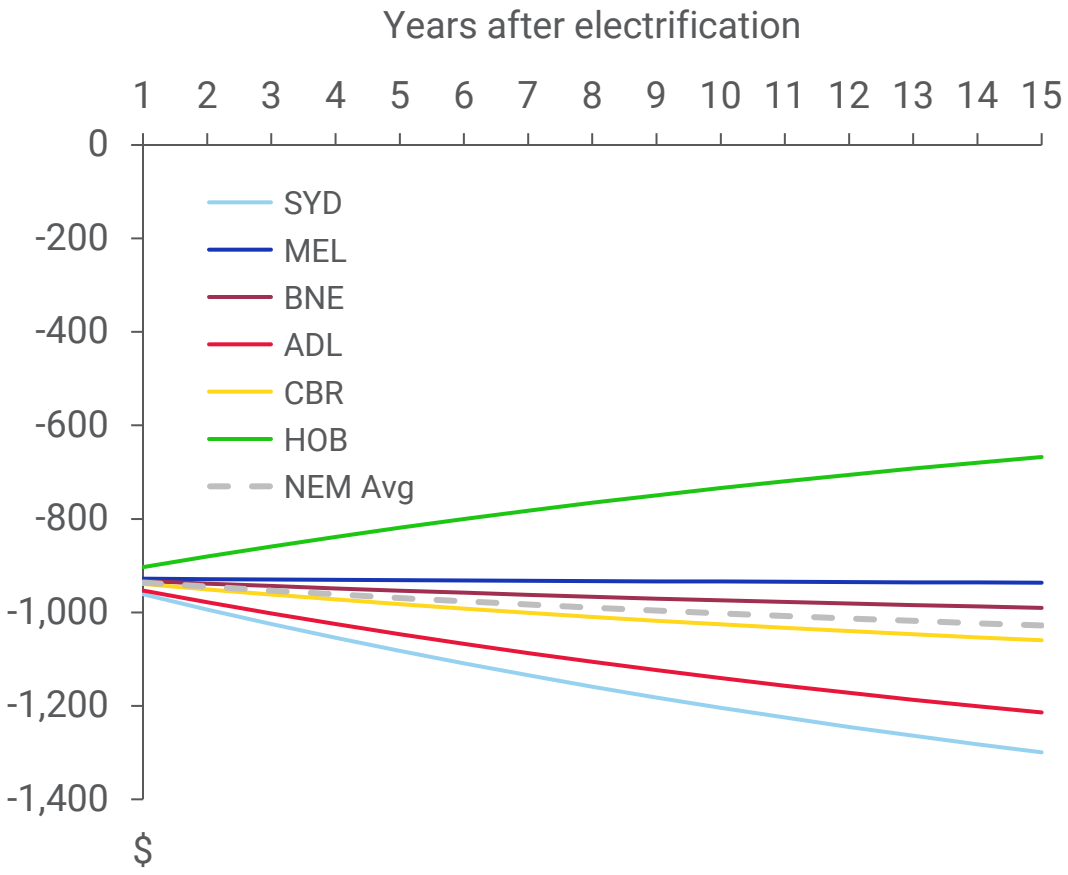
Cumulative net cost saving due to cooktop electrification, by city

2026 $AU; Present values; 5% discount rate; 3-person house



Cumulative net cost saving due to oven electrification, by city

2026 $AU; Present values; 5% discount rate; 3-person house



While electric cooking is about twice as energy efficient as gas cooking, electricity usage rates are about twice as high as gas usage rates when converted to a common unit.

Sources: AEMC Residential Energy Consumer Model.

Cooking electrification makes sense when combined with gas disconnection

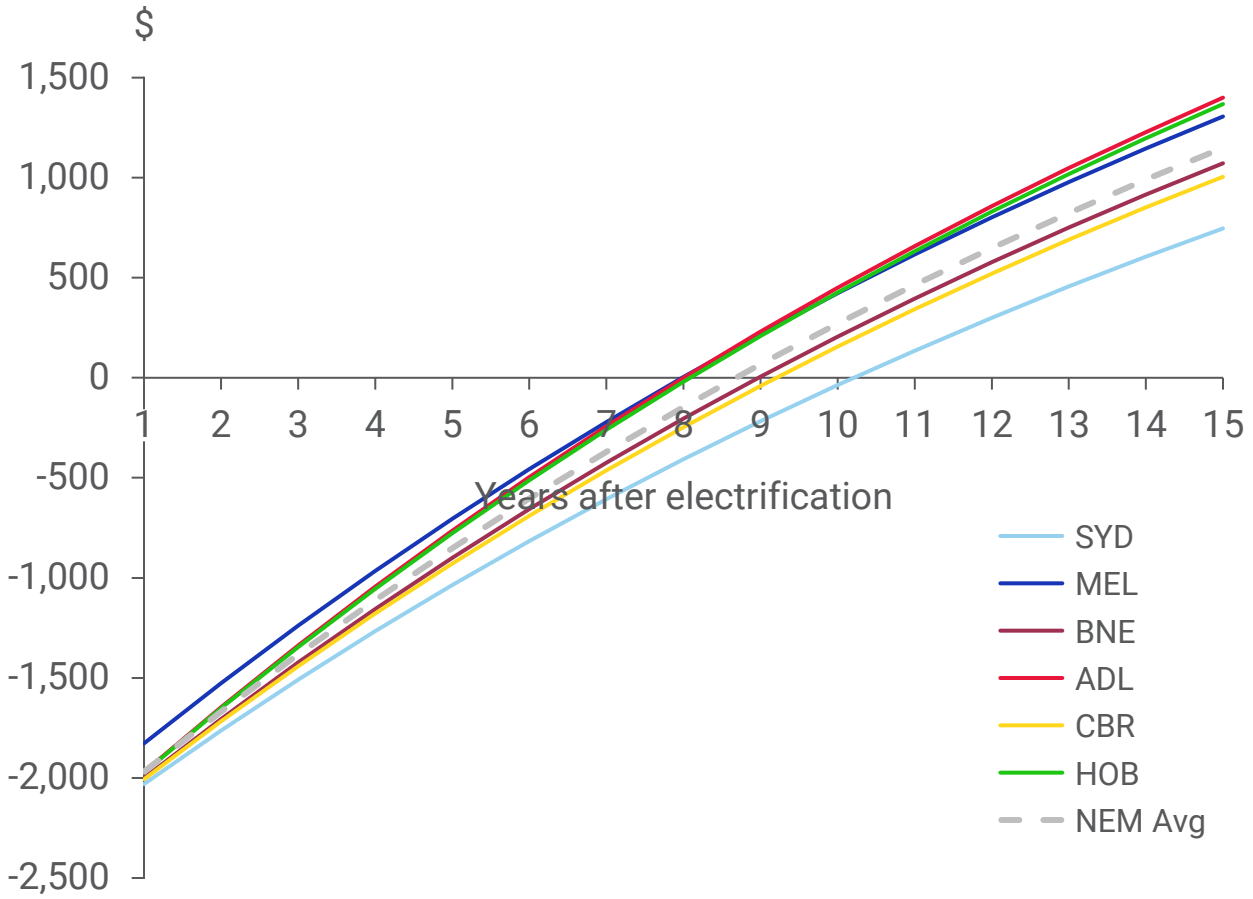
Households connected to a gas distribution network pay a daily supply, or 'fixed', charge of around $1 a day.

Therefore, disconnecting from gas, which can only happen once all appliances are electrified, allows households to unlock cost savings of around $1 a day.

While cooktop and oven electrification may not make economic sense as standalone actions, when they are combined with gas disconnection, payback ranges from 8 to 11 years across NEM capital cities, as the figure to the right shows.

Cumulative net cost saving due to cooking electrification and gas disconnection, by city

2026 $AU; Present values; 5% discount rate; 3-person house

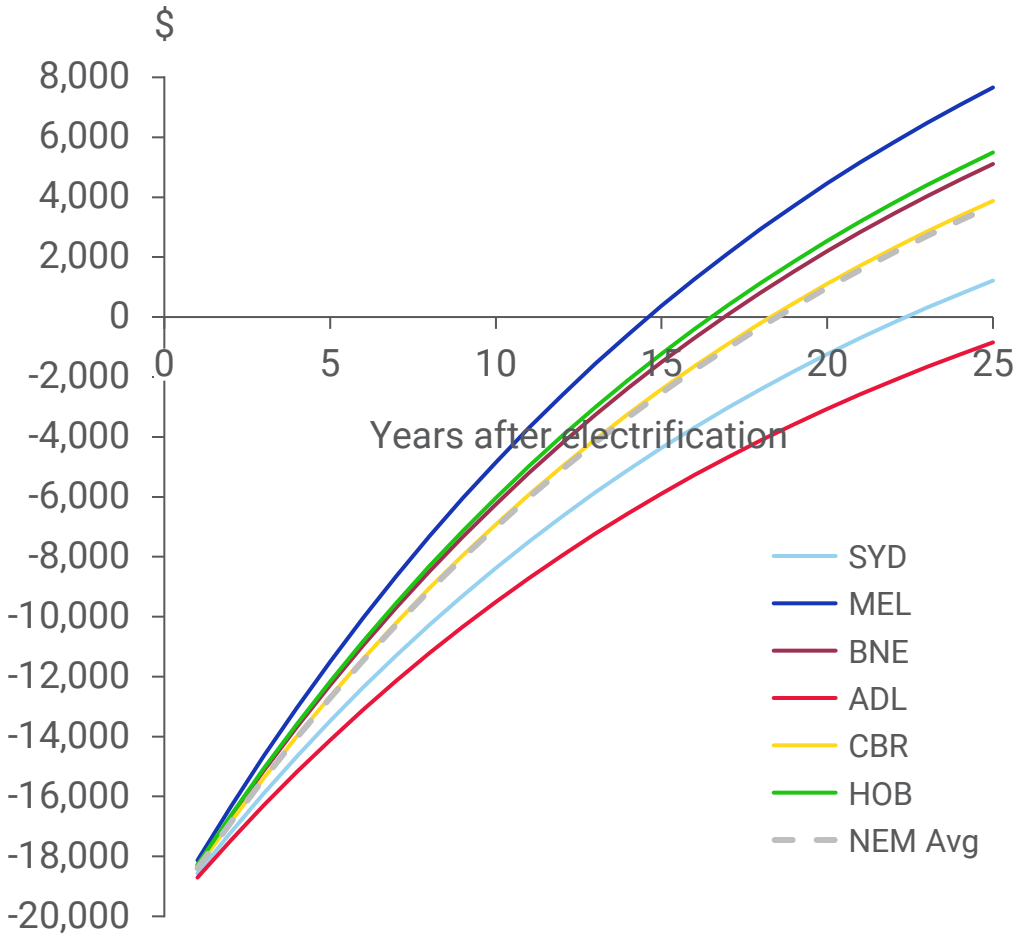


Sources: AEMC Residential Energy Consumer Model.

Vehicle electrification pays for itself fastest in Melbourne and Hobart

Cumulative net cost saving due to vehicle electrification, by city

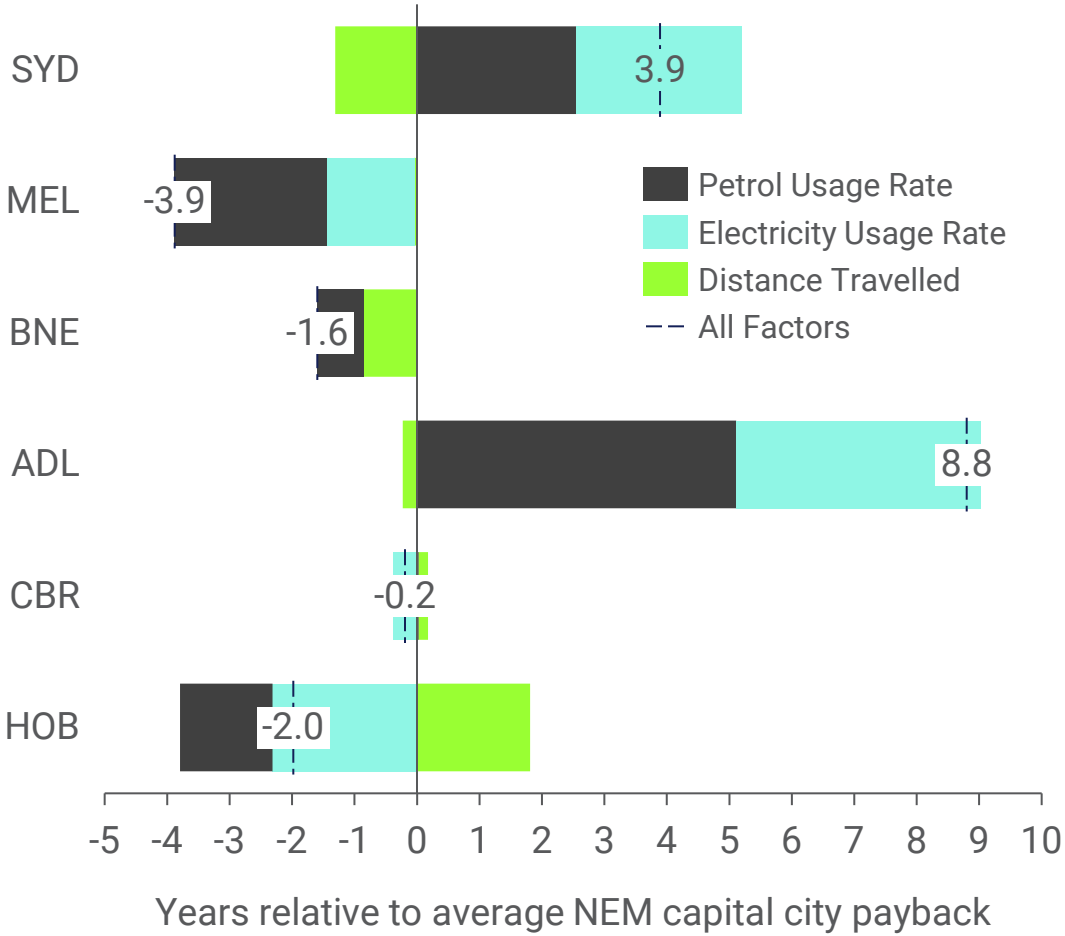
FY26 $AU; Present values; 5% discount rate



Petrol and electricity prices are the main drivers of payback periods

Vehicle electrification payback compared to average NEM capital city payback

Shapley decomposition; Payback in average NEM capital city is 18.5 years



Notes: Petrol prices are Sep'25 quarter average retail prices sourced from the ACCC's Quarterly report on the Australian petroleum industry.
Sources: AEMC Residential Energy Consumer Model.

Higher petrol prices, rooftop solar, and midday charging reduce EV payback

As the previous slide showed, petrol prices are one of the main drivers of vehicle electrification payback periods.

The figure to the right shows that for a 3-person house in the average NEM capital city, an increase in petrol prices from $2/L to $3/L roughly halves vehicle electrification's payback period. EV ownership can also provide greater predictability in household transport budgets.

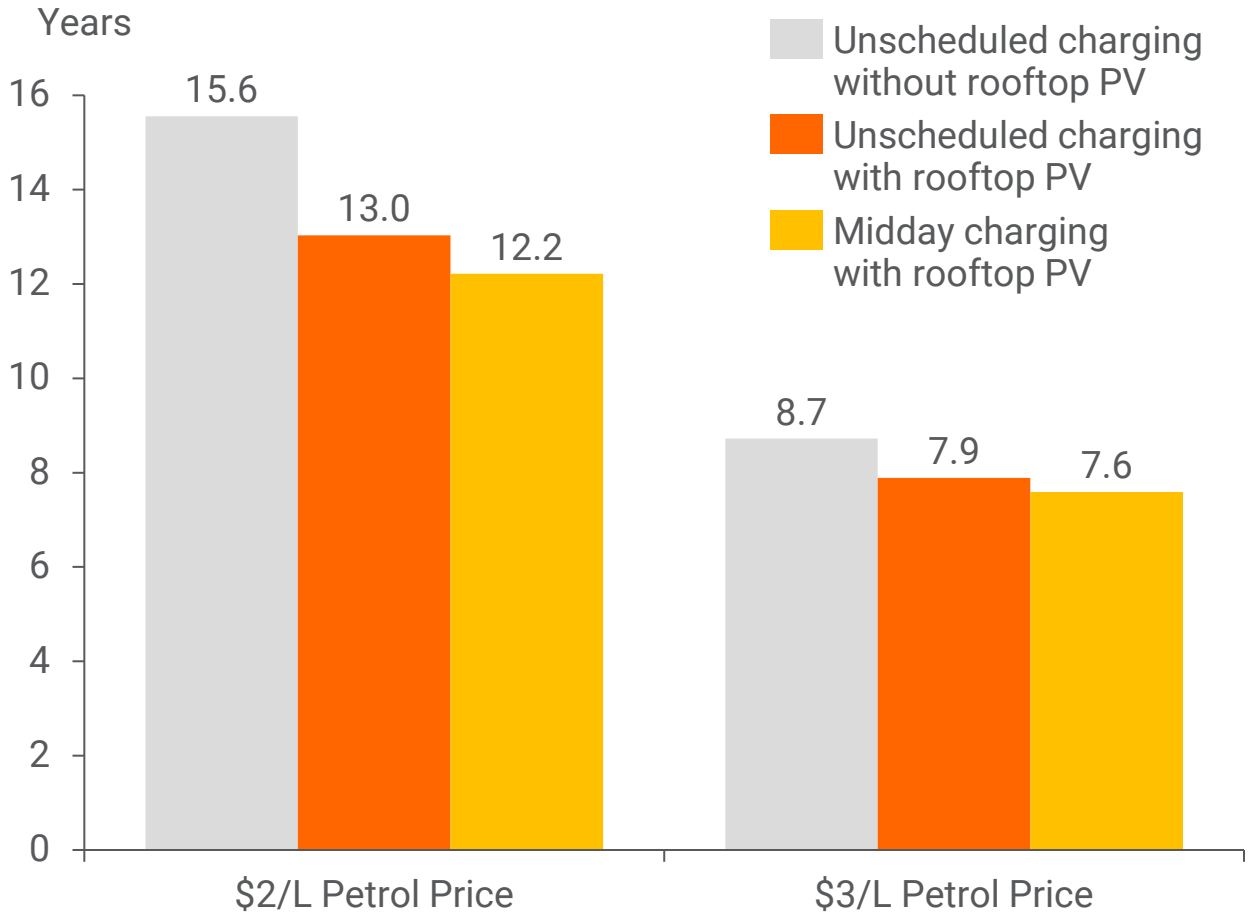
Installing a 10kW rooftop solar system reduces EV payback periods by about 20%. This is because it allows a household to make the most of its low-cost renewable generation. This shows how pricing reforms which promote all consumers benefiting more from low-cost renewable power, as recommended by the AEMC's Pricing Review draft report, would support vehicle electrification.

Shifting when you charge your EV can unlock further incremental savings, but they are not as substantial.

Even with a relatively high upfront 'changeover' cost of $20,000, our analysis suggests EV paybacks can be relatively short in many scenarios. In practice, the upfront cost of an EV can be lower than our assumed $40,000, suggesting that choosing an EV could yield even shorter paybacks than shown here.

Vehicle electrification payback, by petrol price, EV charging profile and rooftop PV status

5% discount rate; 3-person house; Average NEM capital city

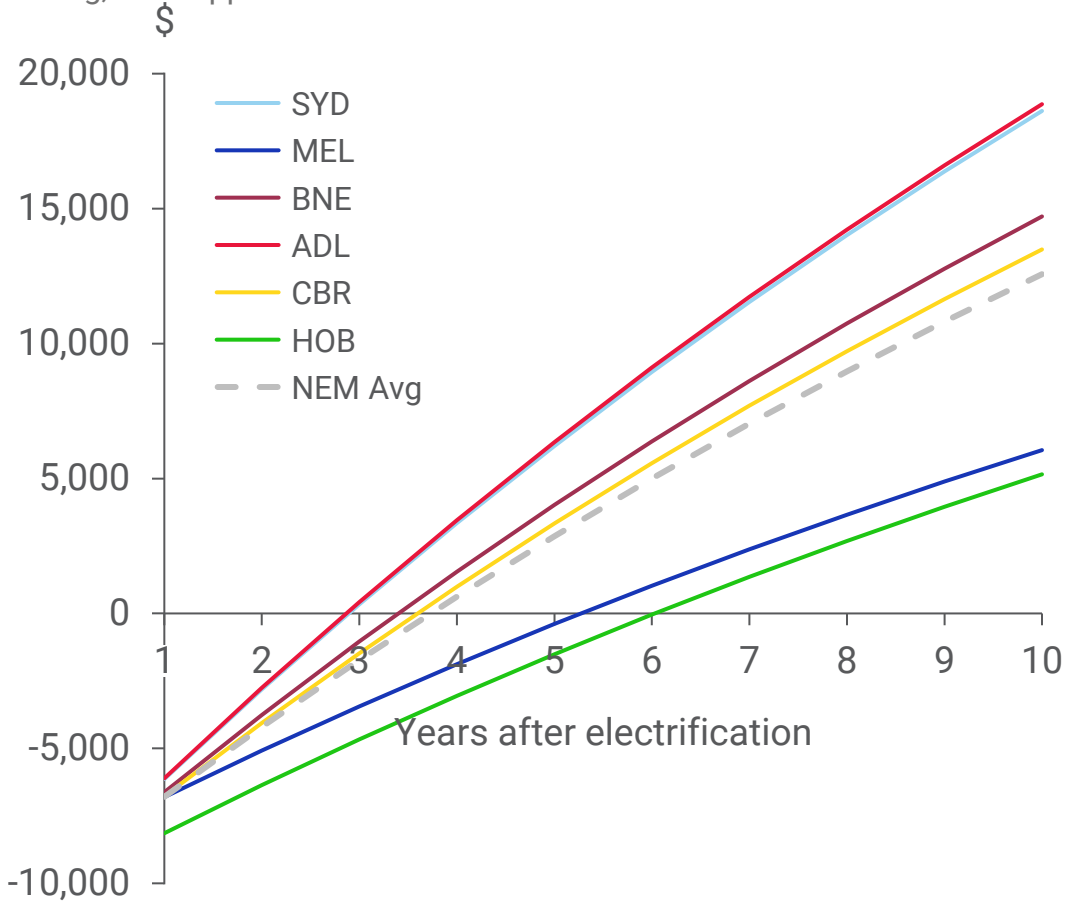


Sources: AEMC Residential Energy Consumer Model.

Rooftop solar installation pays for itself fastest in Adelaide and Sydney

Cumulative net cost saving due to solar installation, by city

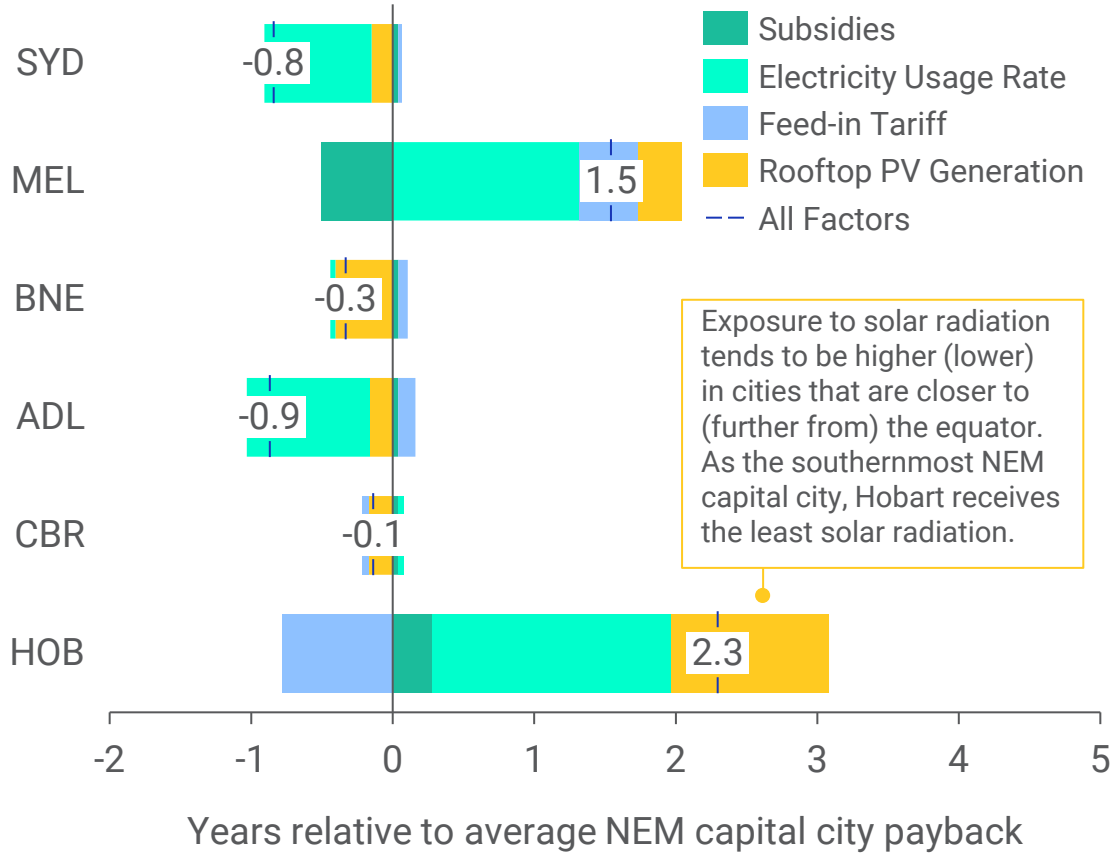
2026 $AU; Present values; 5% discount rate; 3-person house; 3-star thermal rating; Prior appliance and vehicle electrification



Electricity prices and PV generation are the main drivers of payback periods

Solar installation payback compared to average NEM capital city payback

Shapley decomposition; 3-person house; 3-star thermal rating; Prior appliance and vehicle electrification; Payback in average NEM capital city is 3.7 years

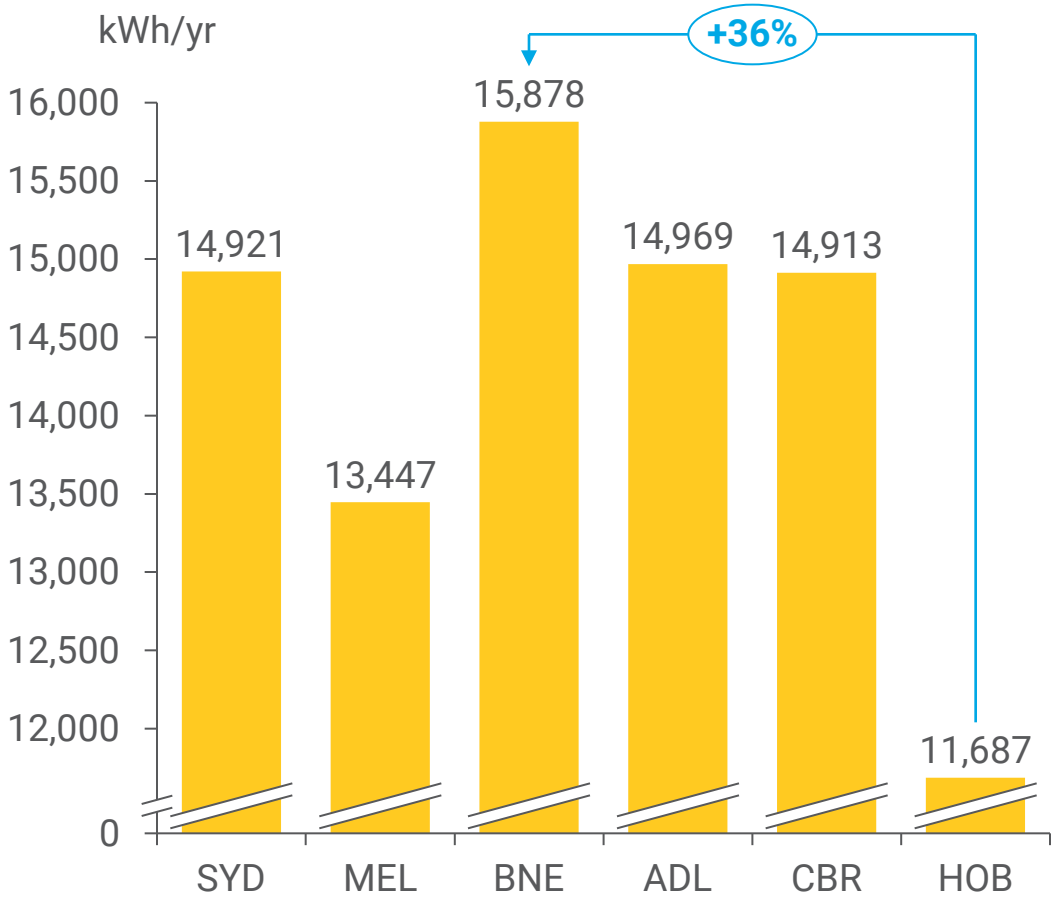


Sources: AEMC Residential Energy Consumer Model.

Rooftop PV generation is greatest in Brisbane and lowest in Hobart

Rooftop PV generation, by city

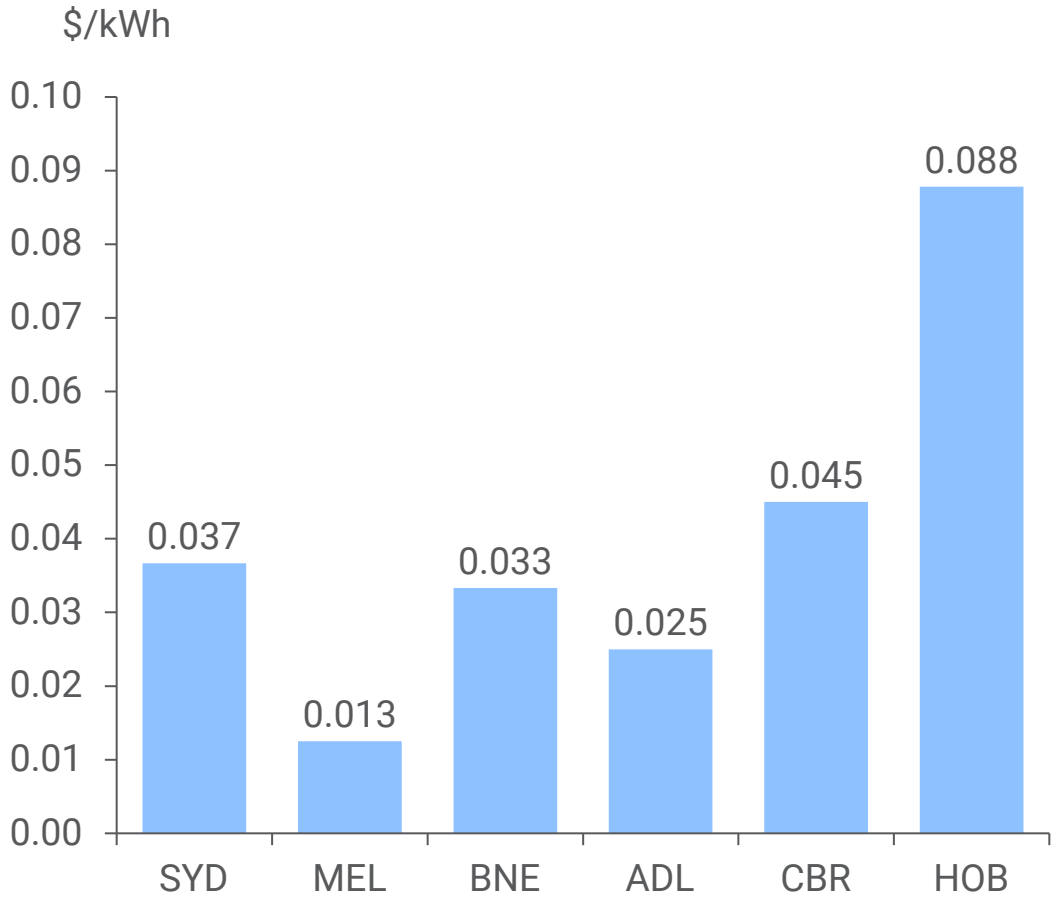
10kW system; PVWatts default settings



Feed-in tariffs are highest in Hobart and lowest in Melbourne

Solar feed-in tariff, by city

Major retailer standing offers

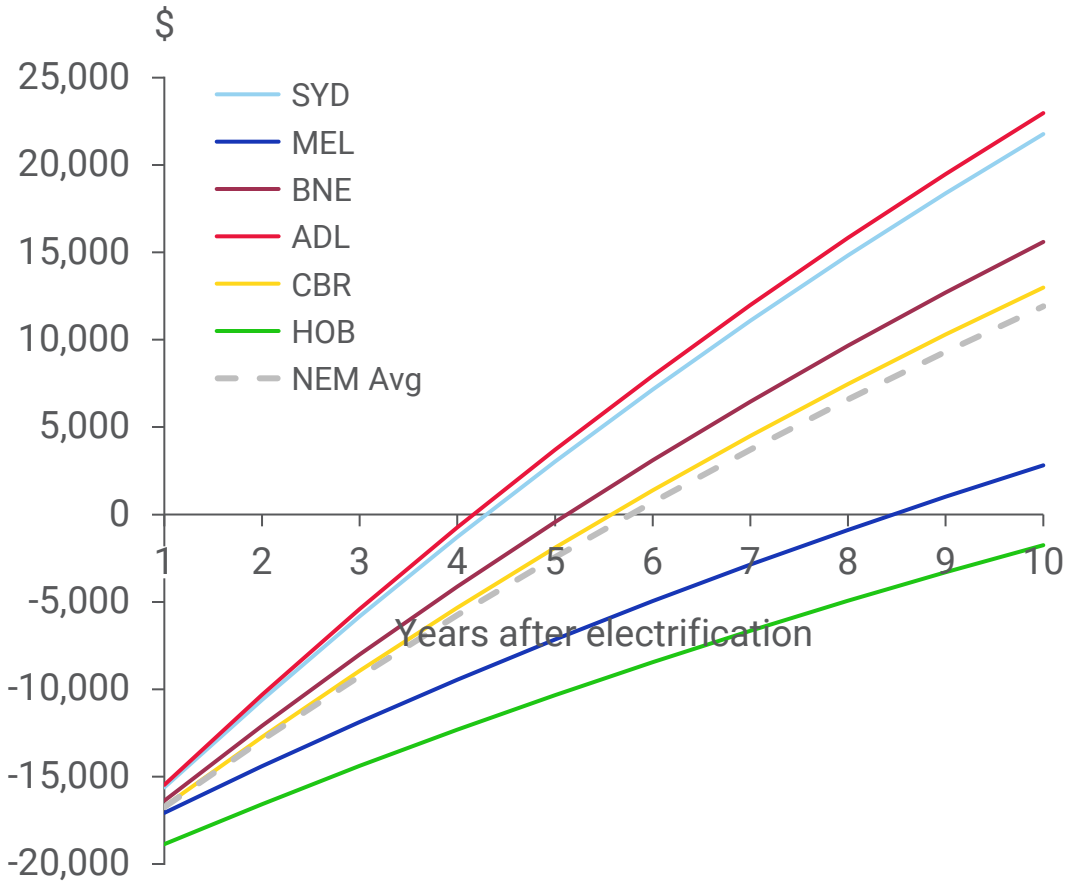


Sources: AEMC Residential Energy Consumer Model.

Solar battery installation pays for itself fastest in Adelaide and Sydney

Cumulative net cost saving due to solar battery installation, by city

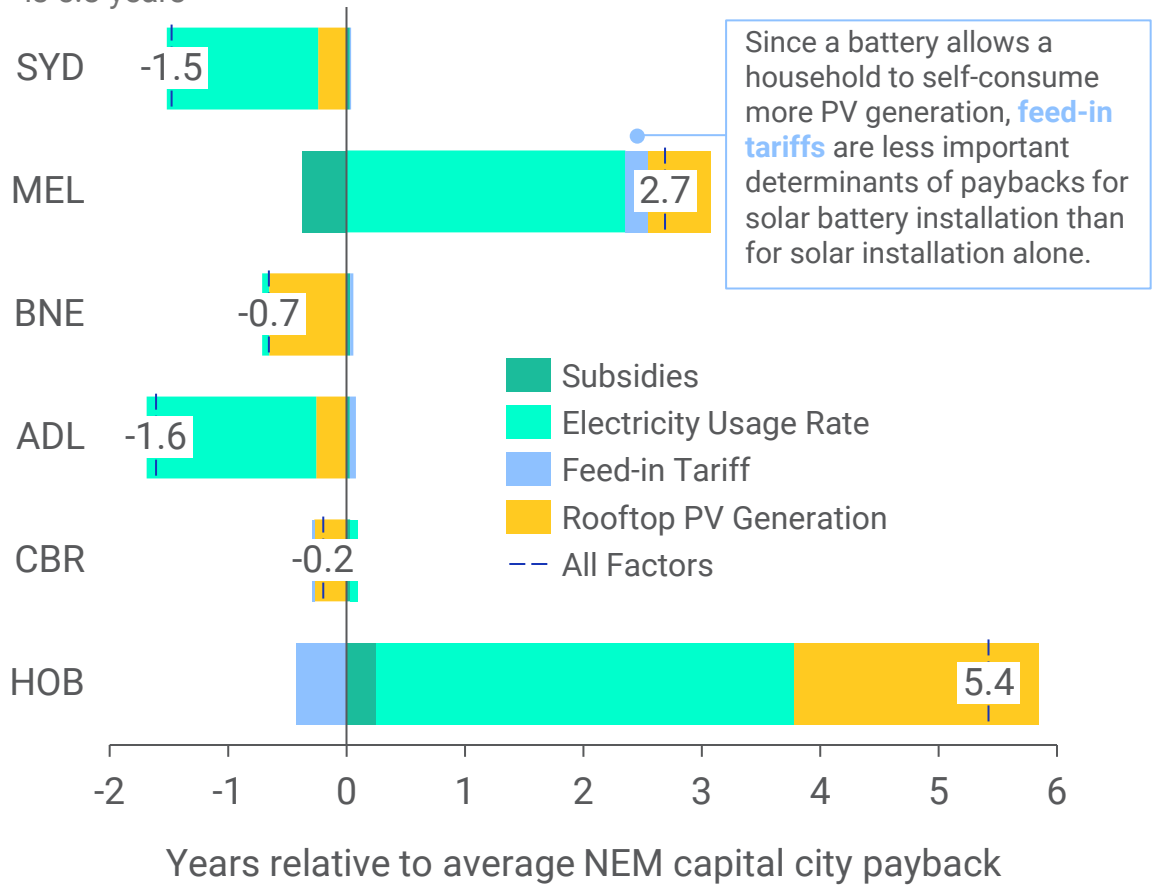
2026 $AU; Present values; 5% discount rate; 3-person house; 3-star thermal rating; Prior appliance and vehicle electrification



Electricity prices and PV generation are the main drivers of payback periods

Solar battery installation payback compared to average NEM capital city payback

Shapley decomposition; 3-person house; 3-star thermal rating; Prior appliance and vehicle electrification; Payback in average NEM capital city is 5.8 years



Since a battery allows a household to self-consume more PV generation, **feed-in tariffs** are less important determinants of paybacks for solar battery installation than for solar installation alone.

Sources: AEMC Residential Energy Consumer Model.

Thermal energy efficiency upgrades can unlock further energy savings

Upgrading the thermal efficiency of a dwelling can generate ongoing space heating energy cost savings.

As the thermal efficiency of a dwelling increases, less warm air escapes the dwelling when it is cold outside, and less cool air escapes the dwelling when it is hot outside. This reduces the amount of heat energy a household needs to add to its dwelling on cold days and the amount it needs to remove on hot days.

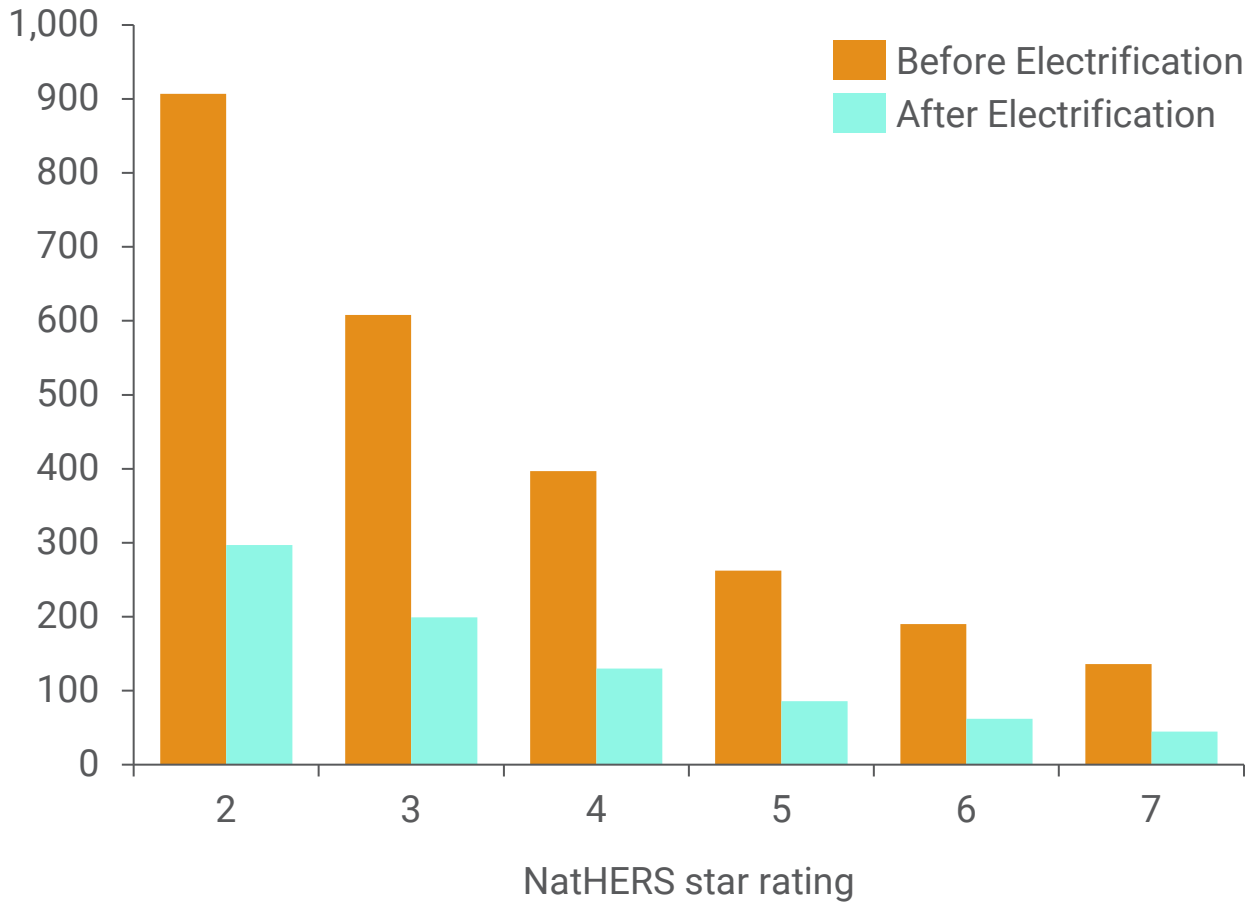
As the figure to the right shows, energy cost savings arising from a thermal efficiency upgrade are greatest for dwellings starting with low thermal efficiencies. In general, they are also greater for households using gas for space heating compared to those using electricity.

A household using gas (electricity) for space heating will unlock annual energy cost savings of around

- $910 ($300) by upgrading from 1 to 2 stars,
- $260 ($85) by upgrading from 4 to 5 stars, and
- $135 ($45) by upgrading from 6 to 7 stars.

Incremental annual space heating energy cost saving from dwelling thermal efficiency upgrade, by thermal rating and stage of electrification

FY26 $AU; 3-person house; Internal floor area of 140 sqm; Average NEM capital city

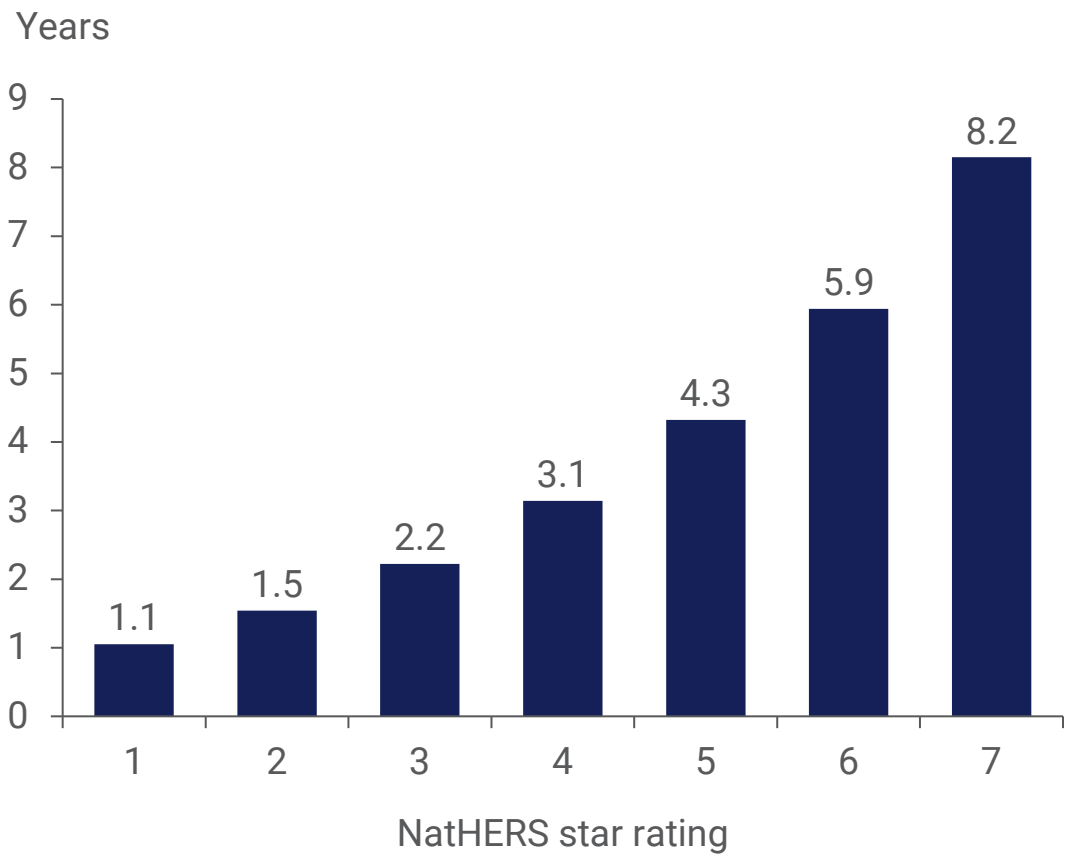


Sources: AEMC Residential Energy Consumer Model.

Space heating electrification paybacks are fastest in thermally inefficient dwellings…

Space heating electrification payback period, by thermal rating

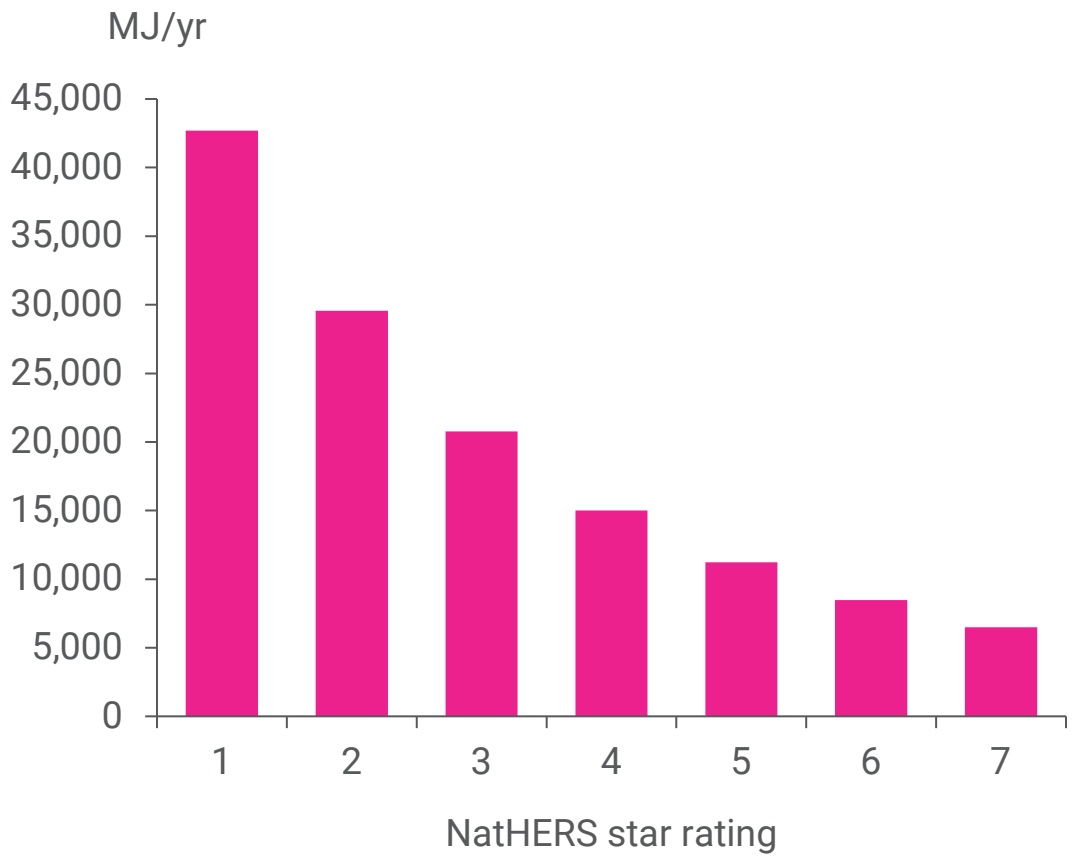
3-person house; Average NEM capital city; 5% discount rate



…as cost savings increase with space heating demand

Space heating demand, by thermal rating

3-person house; Average NEM capital city

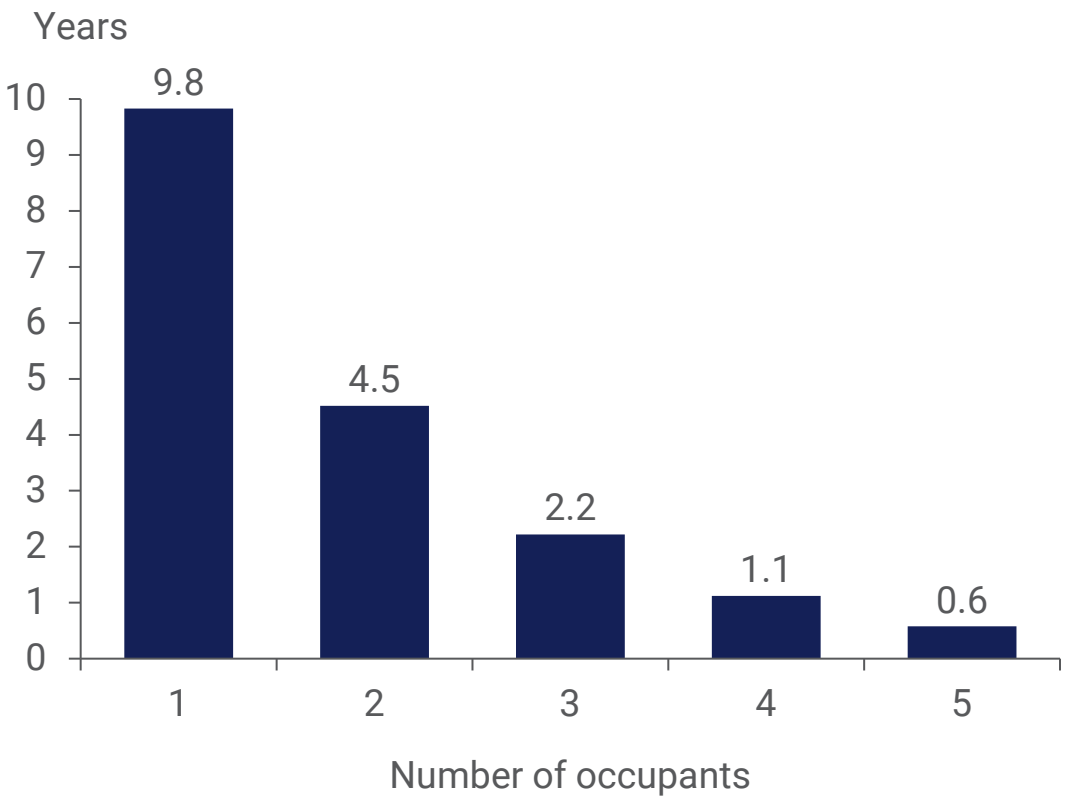


Sources: AEMC Residential Energy Consumer Model.

Larger households enjoy faster paybacks from electrifying…

Space heating electrification payback period, by number of occupants

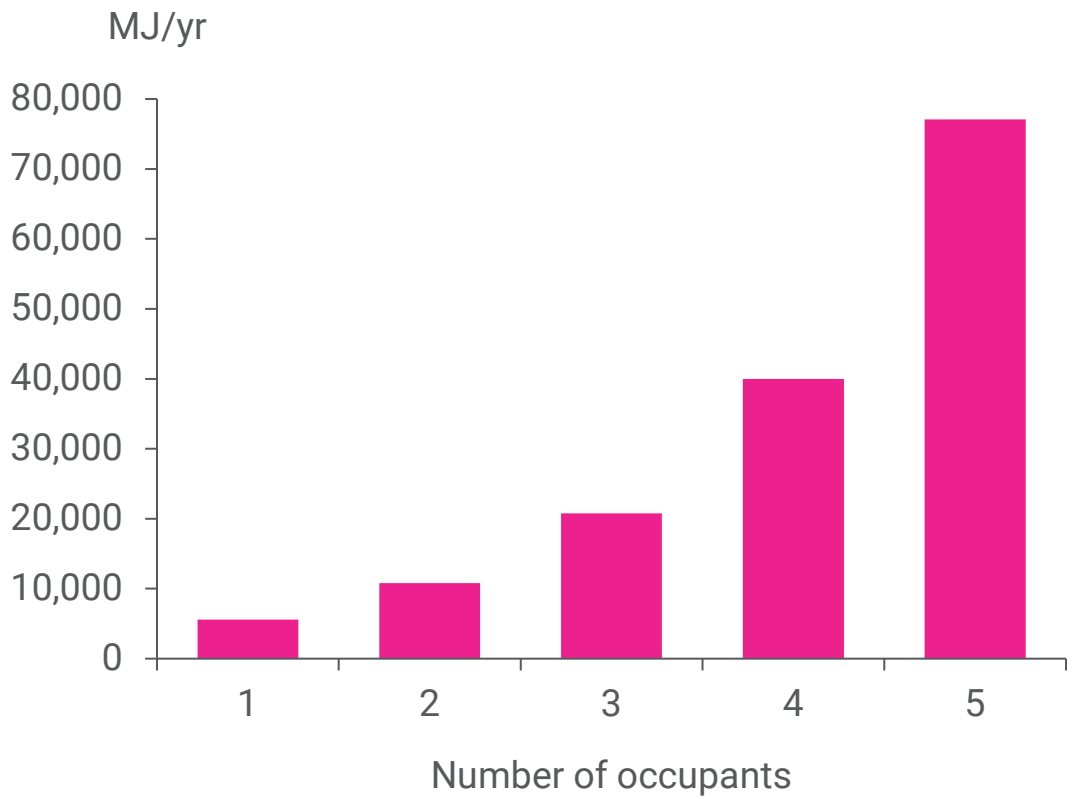
3-star thermal rating; Average NEM capital city; 5% discount rate



…as cost savings increase with demand for energy services

Space heating demand, by number of occupants

3-star thermal rating; Average NEM capital city



We followed NatHERS Whole of Home Calculations Method to model the relationship between a house's internal floor area and its number of occupants.

Sources: AEMC Residential Energy Consumer Model.

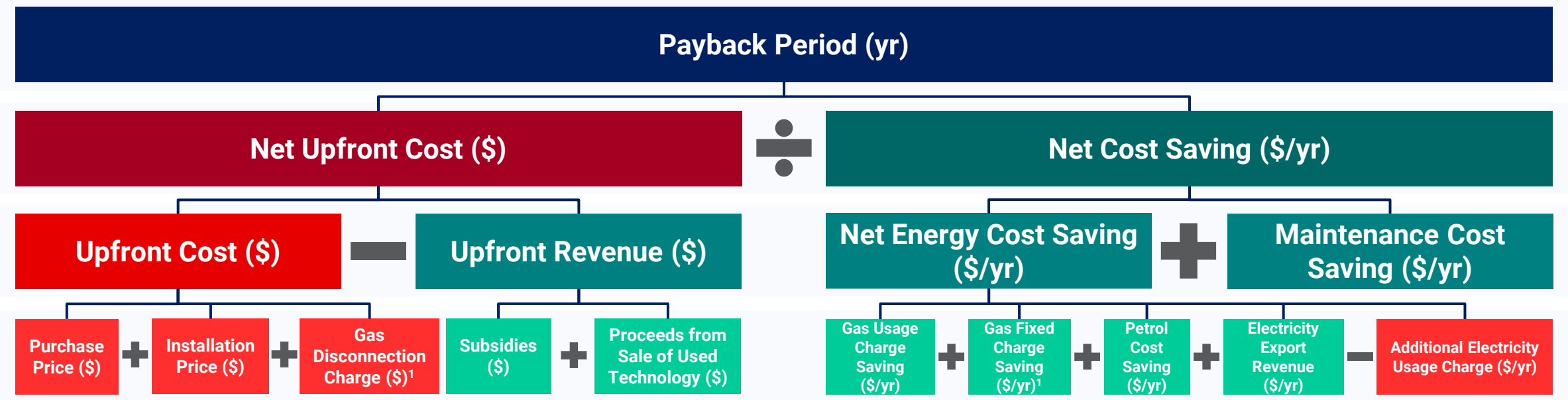
Appendix

Appendix - Payback calculation

Payback period calculation for electrification and solar and battery installation

The following calculation does not discount future cash flows to present value terms

Decelerates payback | Accelerates payback



For ease of illustration, an 'undiscounted' payback calculation is shown in this slide. In practice, we used a modified version of this calculation that discounts future cash flows to present value terms.

Notes: 1. Experienced only after all gas appliances have been electrified.
Sources: AEMC Residential Energy Consumer Model.

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