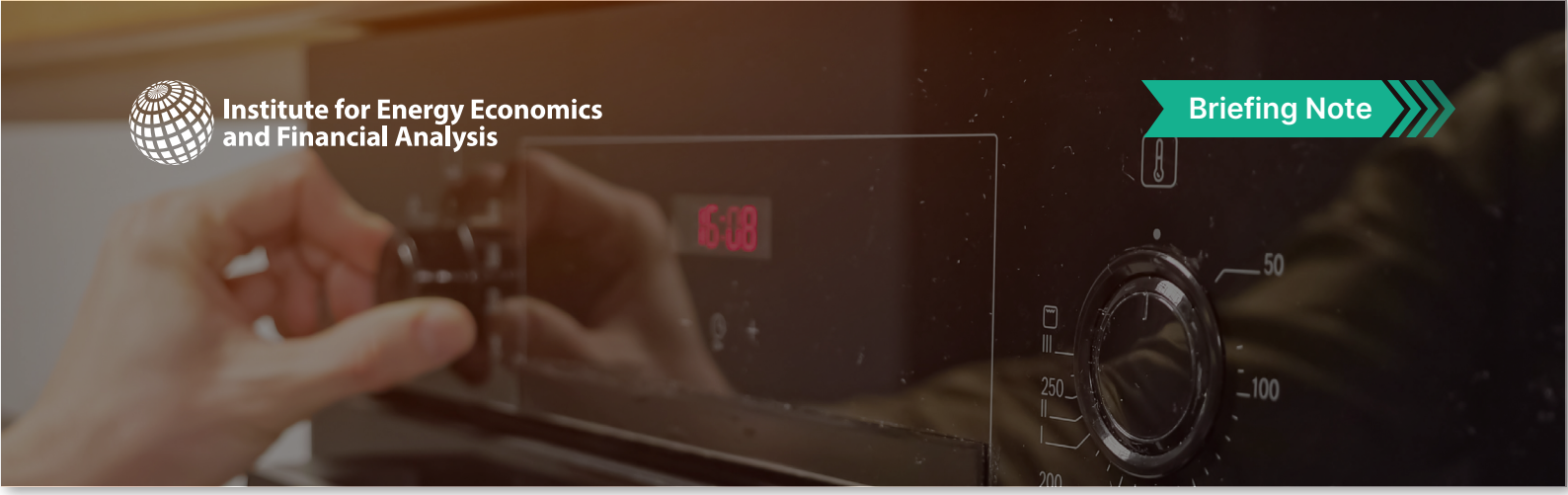

Institute for Energy Economics and Financial Analysis

Briefing Note

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Appliance standards are key to driving the transition to efficient electric homes

- *The continued installation of gas and resistive electric appliances is locking Australian consumers into $3.4 billion in unnecessary costs each year.*
- *Improving minimum energy performance standards for space heating, hot water and cooking appliances via the Greenhouse and Energy Minimum Standards (GEMS) Act could mitigate these costs and help manage the electrification transition.*
- *Improved standards could be complemented by other policies that make efficient electric appliances even more accessible and profitable to consumers.*

Australians use a diverse mix of technologies to keep their homes comfortable, supply their hot water, and cook their meals.

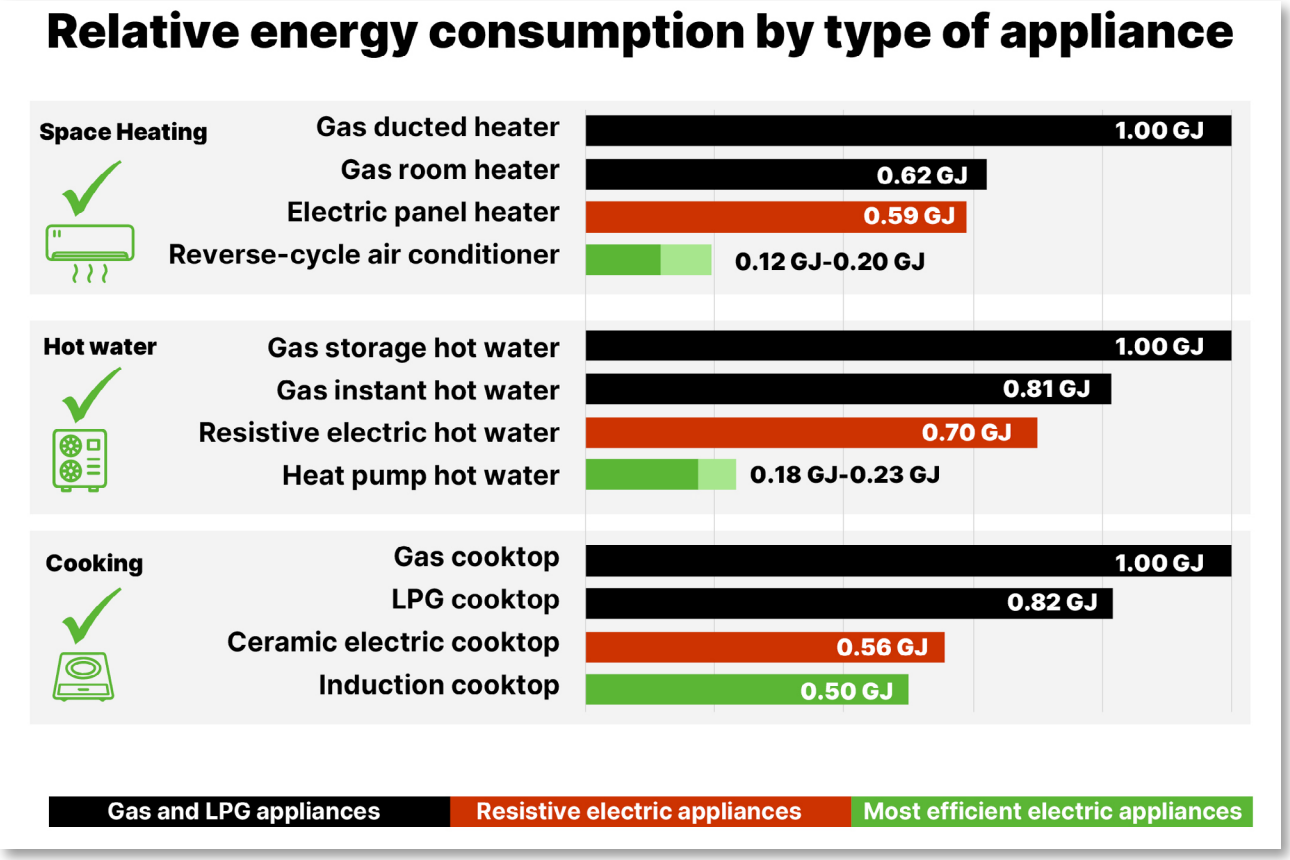
For example, in regions like Victoria and the Australian Capital Territory (ACT), fossil gas has historically provided a cheap source of energy for winter heating, and it still features heavily in the energy mix.

Resistive electric appliances such as radiant heaters, electric storage water heaters and ceramic cooktops are also common in many states – particularly in Tasmania, which has had longstanding access to abundant hydroelectricity.

However, several fundamental shifts are occurring in the way we use energy in the household.

Southern states may be facing excess gas demand events due to Bass Strait gas production declining faster than demand. Gas no longer offers the cost advantage it once did prior to Australia's entry into the global LNG market. In recent years the consumer price index for gas and other household fuels has increased faster than for electricity.

Simultaneously, technologies have advanced to the point where modern electric appliances are widely available that use a fraction of the energy of either gas appliances or resistive electric appliances. The graph below shows the energy required by different appliances to replace one gigajoule (GJ) of energy consumed by the least efficient gas appliance in each category.



Sources for appliance efficiencies outlined in IEEFA – Managing the Transition to All-Electric Homes Technical Appendix (p.24).

Gas appliances are typically the least efficient type of appliances, which is particularly true for gas ducted heating systems. Resistive electric appliances can offer efficiencies close to 100%.

While the idea of an appliance outperforming 100% efficiency seems counterintuitive, heat pumps (used for hot water, and in reverse-cycle air conditioners) do just this by recovering latent heat from the atmosphere. This allows them to have a Coefficient of Performance (CoP, a metric comparable to efficiency) of 300%-500%. This CoP will vary depending on the outdoor air temperature.

Inefficient appliances are still being installed in Australian homes

IEEFA analysed historic sales trends for different types of appliances, and matched these against EnergyConsult's Residential Baseline Study to estimate how many appliances are installed each year in Australian homes.

These trends indicate that large numbers of gas and resistive electric appliances are still installed in Australian homes each year, despite the much lower running costs of efficient electric alternatives.

We estimated that around 940,000 new gas appliances and 800,000 new resistive electric appliances are installed each year.

This includes gas appliances for space heating, hot water and cooking, and resistive electric appliances for space heating and hot water. Resistive electric cooktops are excluded as, though there are practical advantages to switching from ceramic to induction cooktops, the efficiency benefit from this upgrade is not as significant as other upgrades considered here.

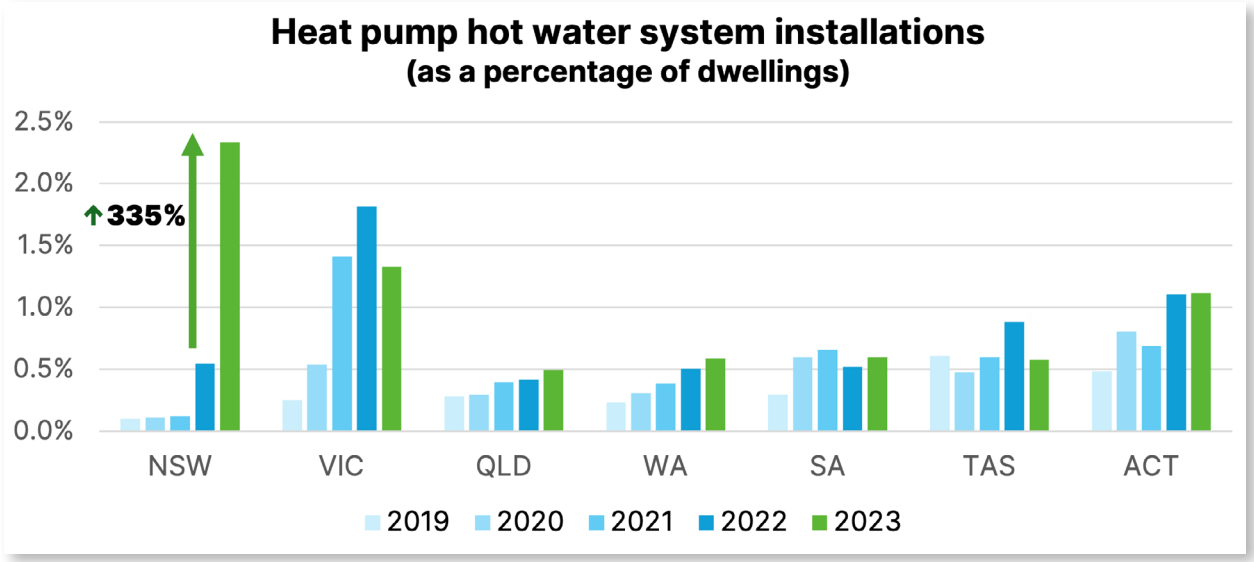
Some states are leading the transition

Since the last update to the Residential Baseline Study, there are signs that some states may be approaching a turning point. Data from the Clean Energy Regulator shows that sales of heat pump hot water systems have surged in recent years.

In particular, heat pump hot water system sales in New South Wales (NSW) have more than quadrupled between 2022 and 2023. This correlates with the introduction of heat pump rebates under the state's Energy Savings Scheme, which is intended to operate until 2050.

Although Victorian sales declined in 2023, its government too has recently introduced new rebates for heat pump hot water systems. Solar Victoria has already reported record numbers of applications for heat pump hot water systems in FY24 to date, which could be the early signs of an acceleration in uptake.

However, these trends are not universal, and uptake is slower in other states and territories.



Source: Clean Energy Regulator (heat pump installations) and Australian Bureau of Statistics (dwelling projections).

These installation figures demonstrate that NSW has the capacity to install more than 25,000 new heat pump hot water systems per quarter, which approximately aligns to IEEFA's analysis of the pace needed to electrify all gas hot water systems in the state by 2050.

Comparing these figures alongside our estimates from the Residential Baseline Study, this could imply that up to 30% of hot water systems sold in NSW in 2023 were heat pumps. However, in practice it is difficult to estimate the actual impact on sales, as it is unclear exactly how many are replacing gas, versus resistive electric hot water systems. It is also unknown how many are replacing fully-functioning hot water systems, compared with those at their end of life. This could diminish the impact on sales of other units.

Given this, and the fact that comparable data is unavailable for other appliances such as reverse-cycle air conditioners, IEEFA has relied on projected appliance installation figures from the Residential Baseline Study for the rest of this analysis. Nonetheless, we continue to follow these recent trends closely.

Consumers lock in $3.4 billion each year they buy inefficient appliances

Appliance purchases are long-term investments. A gas ducted heater, for example, is expected to last around 20 years.

This means that a customer buying a new gas heater today may be locking themselves into up to 20 years' worth of gas costs, which are likely to be significantly higher than the cost of electricity for an equivalent high-efficiency appliance.

Households can of course freely choose to switch appliances before the end of that 20-year lifetime. However, this is equivalent to writing off some of the value of that appliance, which could be avoided if they had installed an efficient electric appliance in the first place.

IEEFA analysed what the upfront and running costs would be over the lifetime of all the new gas appliances we estimate to be installed in Australia each year. We then compared this to the equivalent costs if efficient electric appliances were installed instead.

Our calculations are based on the average retail cost of gas and electricity in each state as of 2023. This is a conservative approach, given that the ongoing decline in production from low-cost Bass Strait gas basins will continue to place upwards pressure on gas prices, while increasing renewable penetration places downward pressure on electricity prices. We also have not factored in users of rooftop solar, who pay less for electricity by offsetting some or all of their grid electricity consumption during the day.

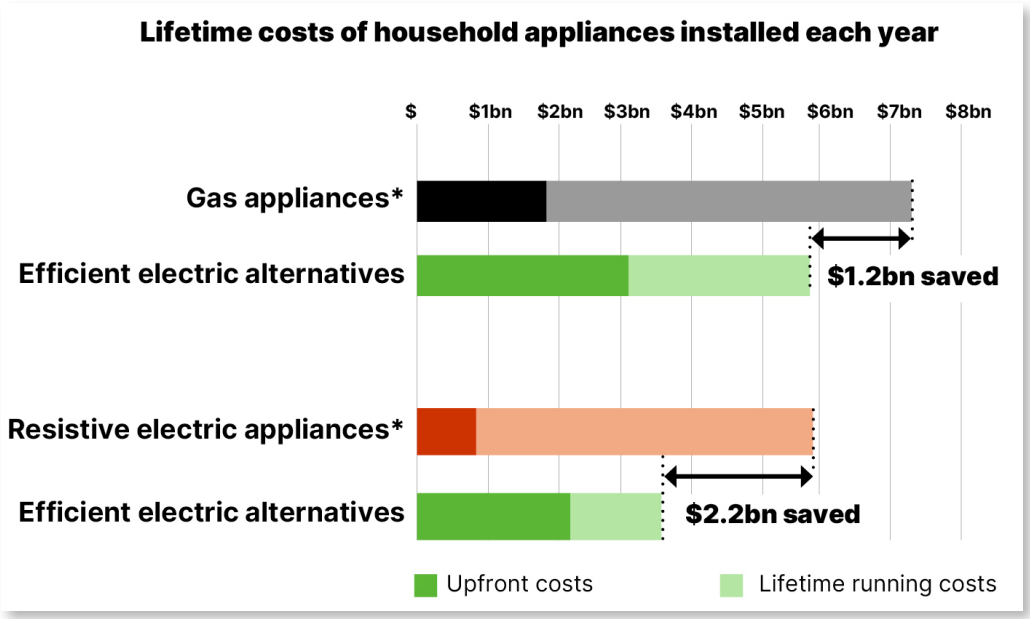
Assumptions from EnergyConsult's Residential Baseline Study indicate that some efficient electric appliances have shorter lifespans than gas appliances (at most, 12 years for a reverse-cycle air conditioner compared with 20 years for a gas ducted heater). To account for this difference, we have made an upwards adjustment to the upfront costs of some efficient electric appliances.

> **Australians would collectively save $1.2 billion over the lifetime of their appliances if all gas appliance sales were switched to efficient electric appliances.**

Even under these conservative assumptions, IEEFA found Australians would collectively save $1.2 billion over the lifetime of their appliances if all gas appliance sales were switched to efficient electric appliances.

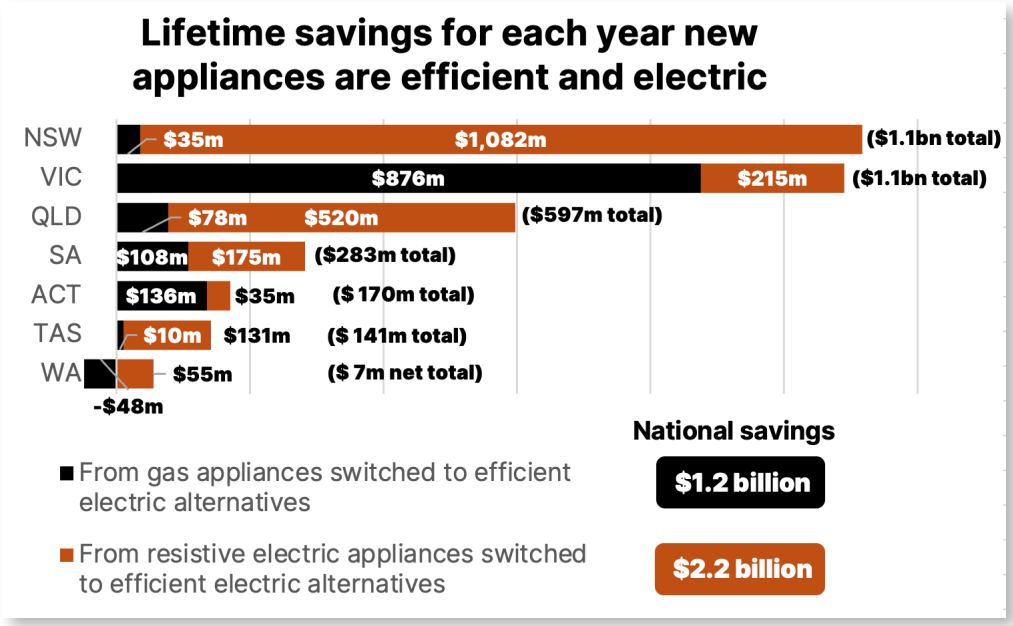
We repeated the analysis for the estimated number of resistive electric appliances installed per year. This revealed that Australians could save a further $2.2 billion for each year that new resistive appliances are switched to efficient alternatives instead.

This leads to a combined lifetime cost saving of $3.4 billion for each year that new appliance sales were efficient and electric, rather than gas or resistive electric, illustrated below:



Net savings are based on the estimate of gas and resistive electric appliances installed each year across Australia. Gas appliance data was unavailable for the Northern Territory (NT) and is excluded.
** Gas appliances include space heating, hot water and cooking appliances. Resistive electric appliances include space heating and hot water only. A full explanation of our methodology can be found in the appendix of IEEFA – How efficient appliances could ease Tasmania's cost of living.*

The distribution of these savings by state and territory is shown below. It varies based on the appliance mix and retail energy costs in each jurisdiction.



In NSW, by far the largest opportunity ($1.08 billion) comes from replacing resistive electric appliances, which make up most space heating and hot water appliances.

In Victoria, where residential gas consumption is much higher than other states, consumers could save a significant $876 million in lifetime costs for each year they purchase efficient electric appliances instead of gas appliances.

The only case where we did not find savings was from switching from gas to efficient electric appliances in Western Australia (WA). This was due to lower retail gas prices than the east coast market, and relatively low demand for gas for space heating (the most economical end use to

electrify). We did however find that if the gas price in WA were to increase by $5/GJ (closer to most eastern states), or if its electricity prices were to decrease by seven cents per kilowatt-hour (kWh), efficient electric appliances would become more cost effective.

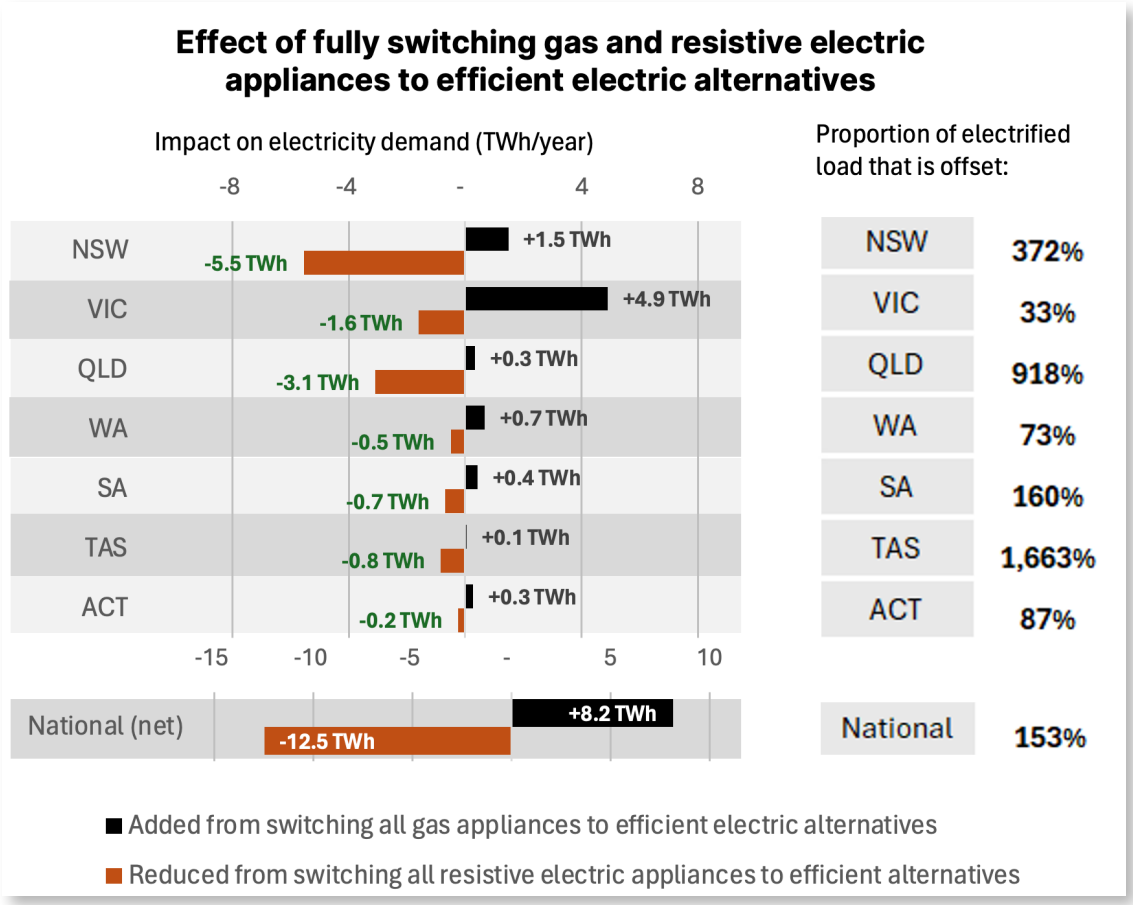
These savings also do not count the fixed charge on consumer gas bills (often more than $300/year), which could be avoided for homes that fully replace all of their gas appliances.

Improved standards could assist the transition

These findings highlight that a single intervention – minimum energy performance standards that require new household appliances to be both efficient and electric – could lead to two significant and complementary shifts in the way we use energy in the home.

On the one hand, it would significantly reduce the stock of household gas appliances over time, gradually moving households over to electric appliances with lower running costs. IEEFA's modelling found that if no new gas appliances were sold from 2025, most homes would be entirely off gas by 2050, thus reducing emissions from residential gas in line with Australia's economy-wide targets.

On the other hand, it would also significantly reduce the stock of resistive electric appliances, replacing them with alternatives that consume less electricity. As well as increasing the savings for consumers, this has the effect of offsetting some or all of the added electricity demand from electrification. In four out of seven states and territories analysed (NSW, Queensland, South Australia and Tasmania), the added demand from electrification is more than entirely offset by switching resistive electric appliances for efficient ones.



Source: IEEFA analysis, assuming full replacement of both gas and resistive electric appliances with efficient electric alternatives. NT is excluded due to poor data availability. Where proportions of electrified load offset are greater than 100%, this indicates a net reduction in electricity demand.

In three regions (VIC, WA and ACT), the additional annual electricity demand from electrification is somewhat, but not entirely, offset by replacing resistive electric appliances with efficient ones.

Nationally, ensuring appliances are efficient and electric through improved energy performance standards would result in a net reduction in annual electricity demand.

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This assessment is based only on annual electricity demand, and further analysis is recommended to explore the impacts on demand at different times of the day and of the year. For example, an increase or reduction in demand from space heating will predominantly affect cooler months.

Many other factors will impact future electricity demand within the residential sector and beyond. However, these findings show the specific impacts of increased appliance energy performance standards can be complementary, and even result in a net reduction in electricity demand in some regions.

The right policies can unlock major benefits

These lifetime cost savings, $3.4 billion, can also be interpreted as the cost of delay for each year that improved energy performance standards for appliances are not in place. If the standards were delayed by two years, the cost extends to $6.8 billion. If delayed for 5 years, it would be $17 billion (or more, if gas prices increase or electricity prices decrease).

Improving energy performance standards for appliances presents a highly attractive policy option because it would effectively require appliances to be upgraded at their natural end of life, which is the most economical time to do so.

Australia has an existing national framework to provide Minimum Energy Performance Standards (MEPS) for household appliances – the Greenhouse and Energy Minimum Standards (GEMS) Act. The federal government's National Energy Performance Strategy (NEPS) identified an objective to "improve the performance of appliances and equipment across all sectors", including to "streamline, expand and modernise the Greenhouse and Energy Minimum Standards (GEMS) framework".

IEEFA recommends that the federal government investigates updating the GEMS Act to:

- Cover a wider range of appliances including all space heaters and cooktops.
- Recognise the efficiency benefits and emissions savings of upgrading gas appliances to efficient electric alternatives (which may require gas and electric appliances to be treated under the same determination).
- Increase MEPS to a level that encourages the uptake of heat pump-based appliances for space heating and hot water, and induction cooktops for cooking.

Previous IEEFA research has also highlighted how updates to the GEMS Act to legislate a demand response capability for priority household appliances could also help to unlock the benefits of flexible demand.

With the right policy supports, improved appliance energy performance standards can also present an equitable approach for renters, who are generally locked out of the choice to switch to higher efficiency appliances. Such standards would require that rental providers upgrade their appliances to efficient alternatives once existing inefficient appliances reach their end of life.

However, some challenges in the transition to efficient electric appliances cannot be solved by standards alone. Supplementary solutions exist that could address these.

Reducing the upfront cost burden

Efficient electric appliances usually cost more to purchase and install than gas or resistive electric appliances. Low or zero interest loan schemes provide a simple financial mechanism to overcome this, but only if they are accessible and deliver genuine net savings to consumers.

Government schemes already exist in Victoria, Tasmania and the ACT. While the ACT scheme covers a broad range of upgrades with a long loan period (up to 10 years), Victoria's schemes are limited to solar or battery investments, and the Tasmanian scheme is limited to a three-year loan period.

More work is needed in this space to design and implement financing solutions that are effective, accessible and profitable for consumers. As an example, Rewiring Australia have proposed an Energy Efficiency Loan Scheme (EELS), where zero interest loans would be offered for household energy upgrades, to be paid back only when a house is sold.

Hard-to-upgrade homes

70% of Australian homes are detached houses, which are one of the easiest archetypes to electrify or switch to higher-efficiency electric appliances. However, a growing number of Australians live in higher-density dwellings including townhouses and apartments.

Some of these dwellings will be easier to upgrade than others. Dwellings that lack outdoor space, and developments with reticulated gas hot water systems pose particular challenges.

New high-density dwellings should be designed to accommodate efficient electric appliances, which could be embedded via the upcoming 2025 amendments to the National Construction Code.

For existing hard-to-upgrade homes, case-by-case solutions may be required. Resistive electric appliances may make sense in dwellings when there is no alternative. However, prioritising other actions – such as off-peak timers for hot water systems, and thermal efficiency upgrades – can help to reduce running costs.

Gas distribution networks

Transitioning to all-electric homes is also likely to significantly disrupt the business model of gas distribution networks, whose assets may become stranded. On average, more than 80% of gas distribution network revenue is recovered from residential customers (around 93% in Victoria).

IEEFA analysis found that the gas distribution networks in Victoria alone could face billions in unrecovered costs if the regulator acted to protect consumers in the transition. However, there is not yet a clear precedent for how stranding risks should be fairly shared between consumers, taxpayers and shareholders of the network. Interim decisions by the Australian

Energy Regulator have seen additional risks transferred onto consumers.

Developing a managed plan to phase down gas distribution networks is an essential part of the transition to efficient electric appliances and should be prioritised by state and federal governments.

Stacking the benefits with other energy-saving measures

The savings calculated here are based on the conservative assumption that all households are purchasing electricity from the grid, while making no change to the thermal efficiency of their dwelling, nor to the time at which they operate their appliances. However, they could be much higher when combined with other cost-effective actions.

Research by Climateworks Centre found that thermal upgrades represented more than half the full potential savings from upgrading an average dwelling. This could reduce both the required upfront investment, and the ongoing running costs for new space heating appliances.

If new heat pump hot water systems are equipped with timers, they can be set to heat up in the middle of the day when solar energy is abundant. This would allow consumers who are on time-of-use tariffs or with rooftop solar to save more money. It would also reduce peak demand impacts on the electricity system by allowing hot water systems to function as a form of energy storage.

Moreover, by installing rooftop solar, consumers can offset a portion of the electricity they need to purchase from the grid. In the near future, more households may be able to access either dedicated battery storage systems or electric vehicles with bidirectional charging. This would allow homes to store excess solar energy produced during the day, to offset even more of their grid electricity demand.

Many of these actions have been identified as priorities by Australian governments, including via a planned National Consumer Energy Resources Roadmap, the National Energy Performance Strategy, and a range of state-based programs. Complementing these with increased minimum energy performance standards for appliances represents a sensible and cost-effective way of maximising the value of these initiatives.

Conclusion

This briefing note does not present a detailed analysis of a particular policy intervention. However, the findings here indicate that increasing minimum energy performance standards for household appliances could be a highly impactful way to unlock long-term cost savings for consumers, and could help enable a managed electrification transition by offsetting some or all of the new loads from electrifying gas appliances.

Through the NEPS, the federal government has identified expansion and modernisation of the GEMS Act as a priority. This presents a window of opportunity to embed changes in the Act that facilitate the transition to efficient electric appliances.

Improved standards should be enacted as soon as practicable, as the cost of delay amounts to $3.4 billion per year in costs borne by Australian energy consumers. They could be supported by complementary policies that make efficient electric appliances accessible to as many consumers as possible and are likely to be amplified by other energy performance solutions, including those that Australian governments have already identified as priorities.

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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