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**Energy Efficiency Council submission to the Senate
Standing Committee on Economics' inquiry into
Residential Electrification**

29 September 2023

Overview

The Energy Efficiency Council (EEC) welcomes the opportunity to make a submission to the Senate Standing Committee on Economics' inquiry into residential electrification. The Energy Efficiency Council is Australia's peak body for energy efficiency, energy management and decarbonisation.

Electrification paired with energy efficiency is the quickest, cheapest way to decarbonise the operations of homes. Electrification relies on proven, commercially-available technology, and takes advantage of the inherent energy efficiency of electric technologies. For new houses, building all-electric makes complete financial sense, and retrofitting existing homes to be all-electric is increasingly attractive as gas prices rise, and householders can take advantage of solar PV to lower their electricity bills.

Efficient, all-electric homes are widely recognised by independent experts as the future of residential energy consumption, with alternative low-carbon technologies unlikely to be cost-effective in a timeframe that is meaningful for achieving our emissions reduction targets. Beyond emissions reduction, electrification can be a powerful antidote to cost of living pressures, relieving stress on households.

While there is a clear consensus among independent experts that electrification will play a central role in the decarbonisation of homes, how this is achieved is very important. Electrification that is done in an efficient, high-quality way can help reduce overall energy system costs and expedite a transition away from fossil fuels. Low-quality electrification, relying on inefficient appliances used without reference to grid conditions will needlessly increase costs for the community. The Energy Efficiency Council's 2023 report, [Clean Energy Clean Demand](#), attached to this submission, sets out how energy efficiency and electrification work hand in hand to achieve residential building decarbonisation at least cost, while also saving money for householders.

There are a range of roles for Government to play in ensuring that electrification is achieved in a way that captures the broad range of benefits. These include investing in skills and training for the workers that will deliver electrification; planning and coordinating a gas network phasedown; delivering effective regulation and standards to assist consumers in making choices that save them money and reduce overall costs to the community and ensuring that vulnerable community members are not left behind in the electrification wave.

The case for residential electrification.

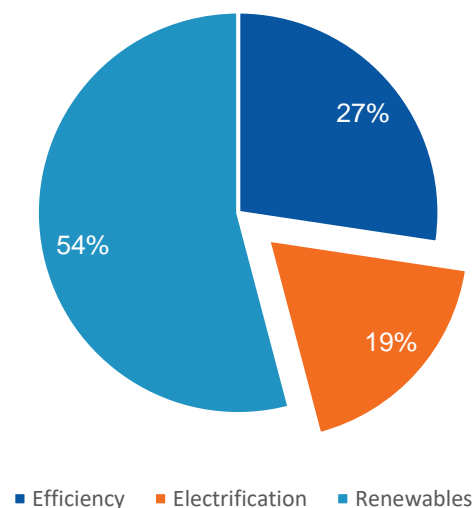
Electrification is the quickest and cheapest pathway to decarbonise residential energy use

Decarbonising our energy systems completely will take time, but a lot can be done immediately. Electrifying building operations, appliances and light vehicle transport are immediately-available opportunities to reduce use of gas and oil, significantly reducing emissions.

In most residential buildings, all services (water heating, space heating and cooling) can be electrified, and with electric appliances being more efficient than fossil fuelled alternatives, the amount of energy we need to power these services is further reduced.

Modelling commissioned by the EEC and ANZ shows that between now and 2050, electrification is expected to play a vital role in reducing residential sector emissions at least cost, contributing 19% of the emissions reductions, alongside energy efficiency (27%) and renewables (54%) (Figure 1).

Figure 1 Sources of residential sector decarbonisation from 2022 to 2050 under an 'enhanced energy efficiency' scenario



Source: EEC and ANZ, May 2023, Putting Energy Efficiency to Work, <https://www.eec.org.au/uploads/Projects/ANZ-EEC%20Putting%20EE%20to%20work%20-%20May%202023.pdf>

Together, these three technologies are expected to decarbonise residential energy use because they are:

- **Available immediately** to be deployed at-scale. Unlike many other abatement technologies that are still in the research and development stage, energy efficient electric technologies are widely available and deployable in households now.
- **Proven**, with more than one-third of households already benefitting from their own rooftop solar PV, and efficient electric appliances delivering energy services for decades in Australia.
- **Cost-effective**, having a much lower marginal cost of abatement compared with alternative technologies such as hydrogen burning appliances, that would require costly upgrades to the gas network.

At present, use of alternative gas technologies such as switching the entire gas network to biogas or green hydrogen is highly unlikely to be a cost-effective, feasible option to replace

fossil gas use. While biogas and/or hydrogen are likely to be highly valuable energy sources in specific, localised applications (such as industrial processes), this is unlikely to be so for residential or small commercial applications.

While biogas is likely to play a role in decarbonising some gas use, limited scale due to a lack of feedstock is likely to constrain widespread deployment. Green hydrogen is likely to be a significantly more expensive avenue to decarbonise building operations. This is due to the substantial upgrades that will be required to make the existing reticulated gas network compatible with 100% hydrogen, and the relatively poor efficiency of converting renewable energy into hydrogen to be used for heating, compared with using renewable energy directly in an electric appliance. Both Australian and international studies have been definitive on this point.¹

Even in energy-hungry European countries without Australia's solar resource, hydrogen as a building energy source has been discounted. The European Academies Science Advisory Committee is definitive on this point:

Renewable hydrogen would be uncompetitive for heating buildings:

Heat for buildings will be increasingly provided by district heating systems or heat pumps rather than by renewable hydrogen that has been produced in the EU because the heat delivered by burning renewable hydrogen will always be more expensive than the renewable electricity used to produce it... Similarly, heating with imported renewable hydrogen will be more expensive than using district heating or a heat pump powered by renewable electricity.²

Indeed a recent meta-analysis of 32 independent studies that examined this question noted that in every case hydrogen was found to be a more expensive option for decarbonising residential heating load compared to alternatives such as electrification.³

Therefore, where technologies exist to use electricity for a given task, these technologies will be more cost-effective than hydrogen or similar alternatives. As electric technologies for residential energy services (cooking, space heating and cooling, water heating) are commercially available at affordable costs, these will be the most cost-effective way to decarbonise building operations.

¹ See for example: Australian Sustainable Built Environment Council, 2022, *Unlocking the pathway: Why electrification is the key to net zero buildings*, <https://www.asbec.asn.au/research-items/unlocking-the-pathway-why-electrification-is-the-key-to-net-zero-buildings/>; Aunedi, M, et al. 2023, 'System-driven design and integration of low-carbon domestic heating technologies', *Renewable and Sustainable Energy Reviews*, vol. 187, article 113695, <https://www.sciencedirect.com/science/article/pii/S136403212300552X>

² European Academies' Science Advisory Council, *The future of gas*, https://easac.eu/fileadmin/user_upload/EASAC_Future_of_Gas_Web.pdf, p.42

³ Rosenow, 2022, *Is heating homes with hydrogen all but a pipe dream? An evidence review*, <https://www.sciencedirect.com/science/article/abs/pii/S2542435122004160#preview-section-abstract>

Electrification is a powerful antidote to cost-of-living pressures

As prices for fossil energy rises, electrification will save households money. Electrification helps reduce these hits, as electric households can take advantage of the inherent energy efficiency of electric appliances, as well as low-cost solar PV generation.

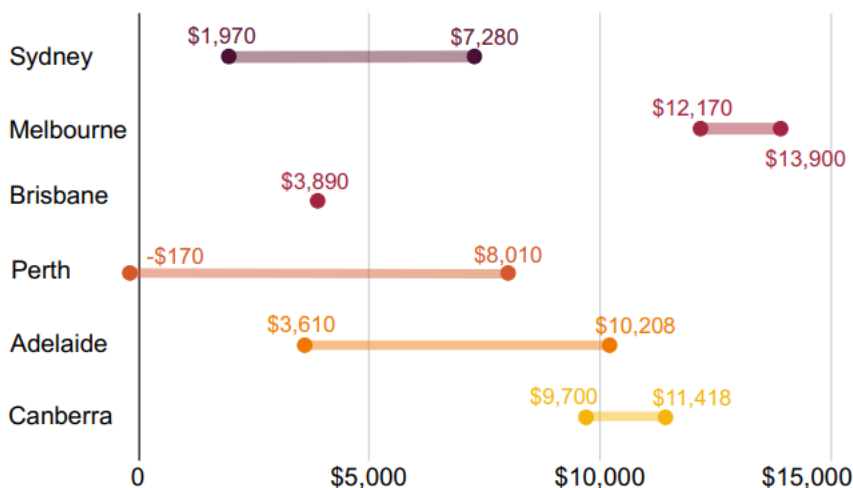
For new dwellings, going all-electric from the beginning makes financial sense. Research by consumer group Renew has found that an all-electric home with solar in Melbourne that meets the 2022 minimum standards of the National Construction Code would have an energy bill **73 per cent** lower than a basic dual-fuel home, saving occupants **\$2,439** in energy costs per annum.⁴

The upfront costs of new all-electric homes are comparable or *less* than a dual fuel home, depending on the building type. Modelling by engineering consultancy GHD for the Victorian Government found that:

- all-electric detached dwellings need cost no more than an equivalent dual-fuel dwelling
- all-electric townhouses on average, can easily cost *less* when compared to an equivalent dual-fuel townhouse; and
- all-electric and dual-fuel apartments involve similar upfront costs with negligible variance⁵.

Occupants of existing residential buildings are also likely to benefit financially by electrifying their home. Research from the Grattan Institute shows that in almost every case, households upgrading to electric appliances will be better off over ten years, even after accounting for the capital cost. While the savings are greatest for those colder climates that have a significant gas space and water heating demand, there will be savings right across the country (Figure 2). These savings are likely to be even greater where a home has solar PV installed.

Figure 2 - Household savings over ten years from electrification



Source: Grattan Institute 2023, *Getting off gas: Why, how, and who should pay?* <https://grattan.edu.au/wp-content/uploads/2023/06/Getting-off-gas-why-how-and-who-should-pay.pdf>

⁴ Renew, 2022, *Limiting energy bills by getting off gas: All-electric homes after the 2022 energy crisis*, <https://renew.org.au/wp-content/uploads/2022/11/Report-Limiting-energy-bills-by-getting-off-gas.pdf>

⁵ GHD, 2022, *All-Electric New Homes Cost Assessment*, <https://engage.vic.gov.au/download/document/27747>

Household energy bill savings are a powerful way to combat cost-of-living pressures. Energy is an essential service and an unavoidable expense for all households – using electrification is a straightforward way to reduce the amount of money households must spend on energy, freeing up household budgets to help with other priorities.

Efficient electrification is key to keeping electricity system costs down

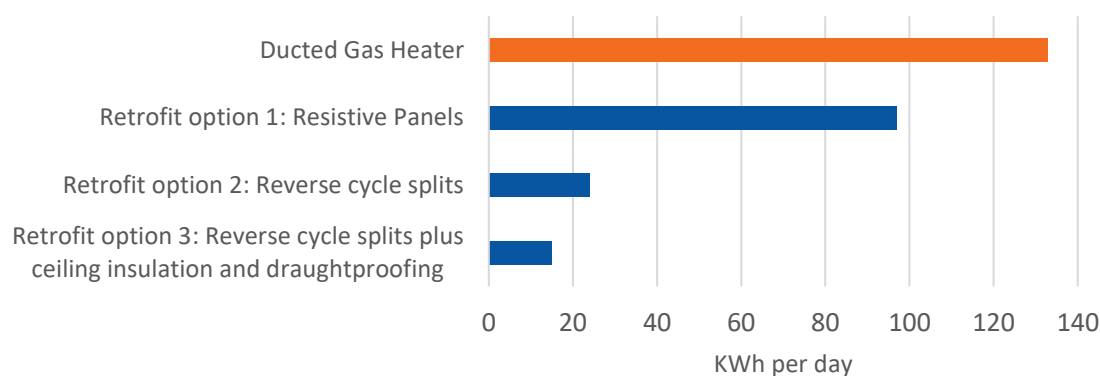
While the efficiency of electric appliances varies, electric appliances are almost always more efficient than equipment that uses fossil fuels. This means that overall, the amount of electrical energy needed deliver services via electricity is less than the total amount of energy needed to deliver the same services via gas or other fossil fuels. In turn, this means that substituting electricity for gas usage will occur on a less-than 1 for 1 basis – the overall increase in electrical demand will be less than the corresponding reduction in gas usage.

However, there are a range of scenarios for electrification. In one scenario, highly efficient, smart appliances reduce the amount of extra demand placed on the grid, lowering costs both for householders and the community in general. In another scenario, less efficient appliances are used at the most costly times, placing high demands on electricity infrastructure, creating high costs for all grid users.

This means that the quality of electrification is important - *efficient* electrification is crucial to a least-cost electric transition. While electric equipment is broadly more efficient than fossil fuel equivalents, there is a huge variation of options amongst electric appliances, some more efficient than others.

For example, replacing a ducted gas heater with reverse cycle air-conditioning will save three times the energy compared with making the switch from gas using electric resistive panels, and partnering the air conditioning with basic thermal efficiency upgrades saves more still. (Figure 3).

Figure 3 Energy required to heat an average Melbourne house on a winter’s day using different heating options



Source: EEC, 2023, *Clean Energy, Clean Demand*, <https://www.eec.org.au/uploads/Projects/EEC%20Clean%20Energy%20Clean%20Demand%20-%202023.pdf>

The precise electric appliances consumers choose will significantly influence the energy savings they enjoy and determine the costs and benefits for the energy system. The largest benefits for consumers and the energy system accrue from electrifying residential buildings with *energy efficient* technologies.

Smart electrification maximises benefits from low-cost solar PV

While residential energy demand is a relatively small portion of Australia’s overall energy use, it is highly misaligned to times of cheap renewable supply: That is, households currently tend to use more energy at ‘peak’ periods in the morning and evening when solar generation is lowest, and less energy in the middle of the day when solar energy is abundant.

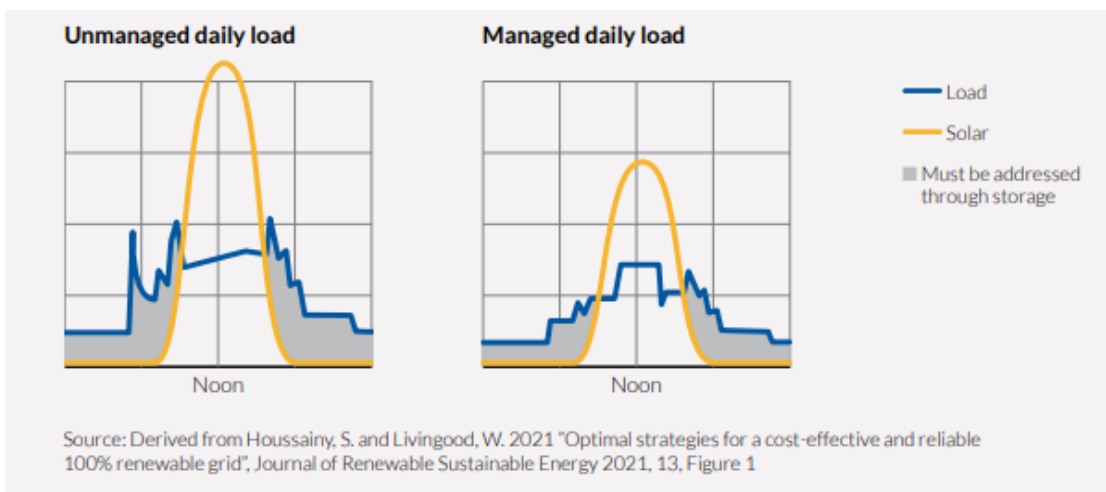
Efficient electric technologies, including increasingly common digitally-enabled ‘smart’ appliances, will be crucial for supporting a larger share of variable renewables in the generation mix and keeping a lid of energy system costs, though:

- 1) **Load shifting:** whereby overall electricity demand is reduced, enabled through energy efficient buildings and appliances that provide more energy services for less energy; and
- 2) **Load shaping:** whereby the time that electric devices are used is shifted to times where cheap, renewable electricity is available (in the middle of the day) and away from peak periods. This is enabled by connected devices, behaviour changes and storage.

Though load shifting and shaping, efficient electric technologies support ‘right-sizing’ of the electricity system, ensuring that investments in generation, transmission and distribution infrastructure are made in proportion to electricity demand. This becoming more important as energy system planners increasingly run up against social license issues with land holders objecting to the construction of large-scale electricity transmission infrastructure.

Further, the use of efficient technologies can reduce the amount of storage infrastructure needed (Figure 4). Efficient energy demand, shifted as far as possible into times when solar energy is abundant, reduces the amount of energy that needs to be stored, and hence minimises the amount of costly energy storage needed. Efficient technologies reduce the overall amount of energy needed, and smart technologies adapt energy use into times of cheap, low-emissions energy supply.

Figure 4 How energy management can reduce expenditure on electricity generation and storage



Where householders use these techniques make their energy use as *efficient* and as smart as possible, they stand to save even more by maximising self-consumption of solar power. This helps maximise the benefits of Australia’s significant investment in rooftop solar, expediting the renewable energy transition.

Electrification brings new opportunities for Australian jobs

The residential electrification wave is likely to require a larger workforce across a range of trades and professions, including electrical, plumbing, HVAC, engineering and others. The nature of electrification means that work is done largely within Australia, creating significant opportunities for a range of skilled workers to develop new business opportunities.

While we do not yet have a firm understanding of the number of skilled workers needed, thousands of electricians, plumbers and other skilled trades will be required for this task. The task of residential electrification is one that will need to be undertaken over the next two decades, meaning that action from governments now will ensure we have the skilled trades and professionals we need to scale up this effort in years to come. In particular, this includes availability of appropriate training and qualification frameworks, as well as quality accreditation and certification to ensure consumer confidence.

Examples of these needs include:

- Plumbing training and apprenticeships must include appropriate restricted electrical licencing to allow plumbers to provide a one-stop conversion of gas water heating to electric heat pumps
- Professional certification of unlicensed trades (such as insulation installers) to ensure consumers have confidence in the quality and safety of installation
- Underwriting of emerging training needs - such as licence endorsements for new technologies - to ensure rapid access to quality training that supports electrification.

Further understanding of Australia's skilled workforce needs will be enhanced through standing up a comprehensive Australian Energy Employment Report, which will help inform workforce planning exercises (such as the Clean Energy Capacity Study).

The pathway to efficient electric homes

Residential electrification is gaining momentum and is likely to be embraced by a wide section of the community over the coming years. However, there are still policy measures that are necessary to make sure that transition to all-electric residential dwellings – and a concurrent phasedown of reticulated gas networks – proceed as cost-effectively as possible.

The EEC makes nine recommendations to maximise the benefits of residential electrification for the entire community, as well as ensure that the transition away from fossil gas does not impose an undue burden on those least able to afford it.

1. Make all new buildings all-electric by 2025 to avoid stranded assets

New buildings can be constructed with existing all-electric technology, at a comparable or lower cost than dual-fuel households. It makes little sense to permit the continued building of gas-fuelled houses at the same time as we commence a phasedown of gas networks.

To cement all-electric new homes, the National Construction Code revision to be delivered in 2025 should require new residential dwellings to be all-electric, to avoid the cost of construction of gas networks that will inevitably become stranded assets.

2. Rehabilitate the existing housing stock

Around eight million houses in Australia were constructed prior to the imposition of mandatory energy efficiency standards, meaning their energy performance can be poor. Estimates suggest existing houses achieve an average rating of 1.8 stars on the NatHERS rating system, while new houses under the 2022 National Construction Code are required to achieve seven stars.

Electrifying existing housing stock without addressing underlying efficiency deficits risks creating sub-optimal outcomes for householders and could unnecessarily increase the costs of electrification.

Efficient, all-electric houses are not only cheaper to run, they are more resilient to the climate extremes that are likely to become more common in the future. Policies are needed to address the existing housing stock, to ensure all Australians have access to safe, healthy, energy efficient, all-electric housing. While the Commonwealth is undertaking some initiatives through the National Energy Performance Strategy (NEPS), all levels of government need to develop policy measures to help rehabilitate existing housing.

3. Invest in community, social and public housing

Investing in the efficient electrification of community, social and public housing – including Indigenous housing – is a clear responsibility for governments. Social housing tenants are unable to undertake electrification activities themselves and must not be left behind by the residential electrification wave.

Investing in social, community and public housing also has spillover benefits – it allows the procurement heft of Government to underwrite development of skills and supply chains, helping drive down installation costs and improving access to electrification technologies for the rest of the community. The Government's investment in improving social and public housing as part of the NEPS is welcome, but a firm target to upgrade all of Australia's 400,000 social, public and community homes should be made by Commonwealth, state and territory governments.

4. Protect vulnerable community members

There are a range of vulnerable community members who will require assistance to undertake electrification activities. If no action is taken, renters and other vulnerable community members that cannot take advantage of electrification will pay high costs to remain on the gas network, as people with greater agency and financial resources take advantage of electrification.

Government support for electrification should be targeted to the most vulnerable community members – especially low income households and vulnerable renters such as elderly community members, those living with a disability, those escaping family or domestic violence, some Aboriginal and Torres Strait Islander communities. Direct investment in electrification upgrades for these community members will support a transition away from gas that ensures these community members do not face unfair financial burdens from continued use of gas.

5. Plan for an orderly gas network phasedown

As electrification takes hold, there will be fewer active, paying connections on the gas network. At some point, the costs of operating the network for a small number of remaining connected households will become excessive, which could lead to a haphazard transition, or even unsafe network abandonment. Leaving a phasedown of the gas network to chance risks a disorderly, 'death-spiral' transition, with the most vulnerable paying the highest cost.

Commonwealth, state and territory governments have a clear role in planning and coordinating electrification and a concurrent gas network phasedown. Electrification should be planned and undertaken on a suburb-by-suburb basis, with clear guidance provided to residents, suppliers and other stakeholders to manage the transition as clearly as possible.

It is not clear that the current National Energy Law framework is fit-for-purpose to manage this transition, and an urgent review should take place to determine how the gas network phasedown can be managed in an optimal, cost-effective way.

6. Stand up the needed skilled workforce and supply chains

Electrification will require significant numbers of additional workers among a range of trades, particularly electrical, plumbing and HVAC trades. While electrification technologies are mature and well-understood, in some cases there are skills and training gaps to ensure that these technologies are deployed optimally, cost-effectively and in a way that maximises financial and emissions reduction benefits for householders and the community.

Governments have a clear role to play, by investing in frameworks for quality and safety, including professional development and certification, alongside traditional VET and higher education frameworks. Governments should also provide strong policy certainty and commit to electrification early to allow suppliers to stand up supply chains. This policy certainty is important as we compete with international jurisdictions for skills and supply – both Europe and the United States have clear agendas to increase their electrification momentum, and lack of policy certainty in Australia puts access to skills and supply chains in jeopardy.

7. Support low-cost, high-quality electrification with effective regulation and standards

Effective, well-designed regulation and standards helps the community capture the maximum benefit of electrification and overcome market failures.

Minimum energy performance standards and **energy performance equipment labelling** helps consumers choose efficient appliances that saves them money and reduces burdens on the electricity network, which in turn reduces cost for the whole community. Commonwealth, state and territory governments should seek to expedite the development of E3 Program standards for a range of important electrification technologies, including heat pump water heaters and electric vehicle chargers.

Commonwealth, state and territory governments should also collaborate on creating **nationally consistent requirements for electrical equipment**, including demand response enabled devices and grid-aware EV charging equipment, helping build a secure and resilient electricity grid. Highly grid-aware and interoperable smart appliances are a necessary foundation to take advantage of flexibility in the grid, and nationally consistent requirements are necessary to ensure a range of products are brought to market.

Minimum energy performance standards for rental dwellings are also an incredibly important part of ensuring that the benefits of electrification are accessible to everyone. With around a third of Australians renting their homes (and lacking agency or resources to alter those homes), minimum rental standards that assure basic levels of thermal performance, as well as access to efficient electrification technologies, are important to overcome split incentives between landlords and tenants, and safeguard the health and wellbeing of those who rent their home. While state and territory governments are principally responsible for rental regulation, the Commonwealth can also play a leadership and facilitation role in this area.

8. Harness energy efficiency schemes to accelerate deployment

In those jurisdictions that have them, energy efficiency obligation schemes have been an effective tool to assist mass deployment of efficient technologies. These schemes, typically funded through the energy system have demonstrated overall bill savings both to consumers who participate, and also to all energy consumers through reducing total energy system costs.

State and territory governments, as well as the Commonwealth, should consider how existing energy efficiency schemes can best support electrification, and how schemes could be established in those jurisdictions that lack them.

9. Deploy residential energy performance ratings to unlock finance

Unlike many comparable jurisdictions, Australia still lacks a nationally-consistent, widely deployed energy performance rating tool for households. The Commonwealth and state and territory governments are currently in the process of finalising a national whole-of-home energy performance rating scheme. Once complete, energy performance ratings should become mandatory to disclose at point of sale of a home.

By providing energy performance information to the marketplace (including information about the electrification or otherwise of a household), consumers are able to better understand how a house will perform. Perhaps more importantly, deploying residential energy ratings at scale can help the finance sector underpin energy upgrades – including efficient electrification – through green finance products. To maximise the opportunity in residential electrification during this critical decade, Commonwealth, state and territory jurisdictions should expedite the development of the rating tool and its rapid adoption into real estate transactions.