Submission No 91

INFRASTRUCTURE FOR ELECTRIC AND ALTERNATIVE ENERGY SOURCE VEHICLES IN NSW

Organisation: Institute of Public Affairs

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[redacted]

Institute of Public Affairs

14 May 2025

Committee Manager
Legislative Assembly Committees on Transport and Infrastructure
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Dear Committee Manager,

Institute of Public Affairs Submission to the Inquiry into Infrastructure for Electric and Alternative Energy Source Vehicles in New South Wales

The Institute of Public Affairs (IPA) welcomes the opportunity to share its research and analysis with the Legislative Assembly Committee on Transport and Infrastructure as it conducts its inquiry into infrastructure for electric and alternative energy source vehicles (EVs) in NSW.

The transition from combustion engine vehicles (CEVs) to EVs—which has been pursued and promoted through government intervention in the motor vehicles market—is an elitist idea that benefits EV companies and owners at the expense of mainstream Australians. It will impose unreasonable costs on Australian families and businesses which will additionally have to carry the burden of an increasingly renewable-laden electricity grid.

IPA analysis finds:

- Electric vehicles subsidies effectively impose a regressive tax on Australian families through higher direct and indirect costs.
- Increased use of electric vehicles will impose an additional burden on an electricity grid that is already struggling with high renewable penetration.
- The debate about electric vehicles is distorted by flawed information that disguises their true environmental cost.

No further taxpayer funding should therefore be spent building or supporting EV infrastructure in NSW. Any additional demand for EV infrastructure should be provided by the private sector.

Electric vehicle subsidies effectively impose a regressive tax on Australian families through higher direct and indirect costs

EVs are generally more expensive than conventional vehicles. The upfront cost imposed on a household for adopting electric vehicles, including the cost of an EV home charger, has been estimated to be approximately $43,974.[1] By way of comparison, the median Australian taxpayer earns $55,619 per annum, while the median household gross income is $92,856 per annum.[2] Previous IPA analysis (attached) estimates that full vehicle electrification could cost NSW households up to $5.53 billion annually to 2050.

The gap between the cost of an EV 'upgrade' and the purchasing power of Australian households is why governments intervene in the market to support the uptake of EVs. But subsidies merely impose some of the costs of EVs on taxpayers at large. For instance, through the NSW EV Strategy, NSW taxpayers are expected to spend almost half a billion dollars to incentivise the uptake of EVs in the form of grants to build charging stations, vehicle subsidies for corporate entities, and the implementation of an emissions rating system and website. In addition, the government also provided rebates and stamp duty exemptions for EV purchases made before January 2024.[3]

The EV subsidies of the NSW government are offered on top of those provided by the federal government such as a higher luxury car tax threshold for EVs.[4] The federal government's New Vehicle Efficiency Standard further subsidises EVs by concocting an artificial mechanism, under the guise of improving vehicle efficiency, by which the sale of more affordable CEVs is penalised.

In addition, owners of EVs are exempt from paying the fuel excise tax, which is used to help pay for roads in NSW and elsewhere. Car owners who do not wish or cannot afford to switch to EVs will have to bear more of the burden of developing and maintaining Australia's road transport system. As the Australian Automobile Association noted:

> All Australian motorists who buy petrol and diesel at the bowser pay 50.8 cents a litre in fuel excise. Separately, the owners of heavy vehicles – such as buses, coaches, and trucks – using public roads pay a Road User Charge for each litre of diesel they buy … Owners of pure electric vehicles (or other zero emission technology vehicles that don't use liquid fuels) don't pay any federal fuel excise.[5]

Even taking into account direct and indirect subsidies in favour of EVs, they are still unaffordable for many if not most Australians. A peer-reviewed study, published in the *Australasian Journal of Environmental Management*, concluded that early adopters of EVs, based on empirical data, are "predominantly male, university educated and have substantially higher incomes".[6]

Using taxpayer money to further subsidise and provide more public infrastructure for the benefit of existing owners of EVs—who tend to have higher incomes—effectively imposes a regressive tax on Australians.

Increased use of electric vehicles will impose additional burden on an electricity grid that is already struggling with high renewable penetration

NSW's power grid has already been made vulnerable, on the supply side, by the rapid increase of variable renewable (wind and solar) generation. The closure of Liddell and the failure of Kurri Kurri to come online in-time for Liddell's decommissioning have exacerbated the grid's supply-side reliability issue. Transport-sector electrification will exacerbate reliability issues from the demand side of the equation.

The Australian Energy Market Operator's (AEMO) 2023 National Electricity Market Electricity Statement of Opportunities report (ESOO) identified a reliability gap in NSW starting from the upcoming 2025-26 financial year. The forecast reliability gap was expected to be more severe than predicted in the most recent update to the previous year's ESOO.[7]

A subsequent update to the 2023 ESOO forecasted a further escalation to the NSW electricity grid's supply reliability gap between the 2025-26 and 2027-28 financial years.[8] And it was only after the decision was made to delay the retirement of the Eraring coal-fired power station, following the publication of IPA Research *Liddell The Line in the Sand*,[9] that the forecast reliability gap was able to be addressed for the aforementioned period.[10]

AEMO predicts that electrification, in no small part due to the expected uptake in electric vehicles, will add roughly 9 TWh worth of energy demand per annum to the NSW electricity grid by the financial year ending 2030, and roughly 37 TWh worth of energy demand per annum to the NSW electricity grid by the financial year ending 2050.[11] These will be the equivalent to roughly 12 per cent and 49 per cent of the current annual generation of the NSW electricity grid respectively. These additional consumptions, attributable to electrification, will be on top of existing electricity demand from households and industries.

Policies which will have the effect of accelerating electrification, such as spending or incentivising capital expenditure on EV chargers, further risk the reliability of the state's electricity network, which is already struggling from increased renewable penetration.

The debate about electric vehicles is distorted by flawed information that disguise their true environmental costs

The policy debate surrounding the transition to EVs is distorted by misunderstandings about the nature and potential costs and benefits of EVs. Claims regarding the carbon neutrality of EVs, for example, are a myth. As author and communications professional, John Kananghinis, observed in the Summer 2022 edition of the *IPA Review*:

> [T]he production and powering of EVs, in many cases, simply displaces the production of the CO_2 to the mining, manufacturing, and power creating locations … An EV does not generate CO_2 benefit until almost the end of an assumed 150,000 km life.[12]

Environmentalist Bjørn Lomborg questioned the sustainability and environmental credentials of EVs, which tend to be far heavier than CEVs and therefore require considerably more material in terms of volume and complexity:

> Manufacturing electric cars is mineral-intensive. A comprehensive transition will increase demand for cobalt, nickel, and manganese by 40 to 80 times by 2050. Lithium demand will explode to 140 times its current use for electric cars, with cars and storage annually gobbling up more than 10 times current annual global production. There are ethical problems with this production: most cobalt mining in [the] Congo uses child labour. There are also security problems, given that mineral processing is concentrated in China.[13]

Research published by Melbourne University claimed: 'Vehicle emissions may cause over 11,000 deaths a year', implying that CO_2 emissions from CEVs lead to the deaths of thousands of people per year.[14] In a direct correspondence to the IPA, Melbourne University clarified that the deaths were not, in fact, related in any way to CO_2 emissions from CEVs. Rather, the deaths were attributable to particulate matters and harmful gases, the discharge of which can be addressed through filtration and other technologies without the government necessarily needing to replace CEVs with EVs.

In fact, the transition to EVs may have the potential to *increase* the number of preventable deaths. A 2021 study, published in the academic journal *Atmosphere*, found that in two-thirds of American states, electric cars emit more of the most dangerous particulate air pollution than gasoline-powered cars.[15]

The justification for government interference in the motor vehicles market, to promote the sale and use of EVs, is inadequate at best. Rather than address market failure, it will serve to further distort the functioning of the free market and act as a regressive tax on Australian families and businesses.

Kind regards,

Dr Kevin You
Senior Fellow
Institute of Public Affairs

Attachment: *Wire Consequences: Analysis of the cost and impact of nationwide electrification*

[1] Net Zero Australia (July 2023) 'How to make net zero happen': https://www.netzeroaustralia.net.au/wp-content/uploads/2023/09/Net-Zero-Australia-Mobilisation-How-to-make-net-zero-happen-updated-19-Sep-23.pdf.
[2] Michelle Bowes, 'What it takes to be in Australia's top 1 per cent (in 6 charts)' (*AFR*, 23 March 2025).
[3] NSW Government (2025) 'NSW Government's Electric Vehicle Strategy: https://www.nsw.gov.au/driving-boating-and-transport/nsw-governments-electric-vehicle-strategy.
[4] RACV (July 2024) 'Electric vehicle rebates, discounts and incentives in Australia': https://www.racv.com.au/royalauto/transport/electric-vehicles/electric-car-discounts-government-incentives-australia.html.
[5] Australian Automobile Association 'How fuel excise pays for our roads': https://www.aaa.asn.au/fuel-excise-explained/.
[6] Anna Mortimore, Shyama Ratnasiri, and Md Sayed Iftekhar, 'Who is buying electric vehicles in Australia? A study of early adopters' (2024) 21(2) *Australasian Journal of Environmental Management* 129-135.
[7] AEMO (August 2023) *2023 Electricity Statement of Opportunities*.
[8] AEMO (May 2024) *Update to the 2023 Electricity Statement of Opportunities*.
[9] Scott Hargreaves, Daniel Wild and Kevin You (May 2023) *Liddell The Line In The Sand*.
[10] AEMO (August 2024) *2024 Electricity Statement of Opportunities*.
[11] Based on the Step Change scenario.
[12] John Kananghinis, 'Costs the Earth' (*IPA Review*, January 2023).
[13] Bjorn Lomborg, 'The muddled reality of electric cars: From dirty power sources to heavy batteries to intensive mining, the climate benefits don't add up' (*Financial Post*, 1 December 2022).
[14] Beth Barber (February 2023) 'Vehicle emissions may cause over 11,000 deaths a year, researchers say', *University of Melbourne*: https://www.unimelb.edu.au/newsroom/news/2023/february/vehicle-emissions-may-cause-over-11,000-deaths-a-year,-research-shows.
[15] Andrew Burnham, Zifeng Lu, Michael Wang and Amgad Elgowainy (November 2021) 'Regional Emissions Analysis of Light-Duty Battery Electric Vehicles' (2021) 12(11) *Atmosphere* 1482; Bjorn Lomborg, above n 13.

Institute of Public Affairs

WORKING PAPER SERIES

Wire Consequences

Analysis of the cost and impact of nationwide electrification

Working Paper No. 03/24
September 2024

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Wire Consequences

Analysis of the cost and impact of nationwide electrification

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Working Paper 03/24

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Introduction

Proponents of the policy of net zero emissions by 2050 and rapid transition to renewables are in two minds about the role of natural gas in the future of Australia's energy networks.

Groups like Net Zero Australia, for instance, are calling for a large-scale expansion of and investment in Australia's gas infrastructure.[1] Former head of the Energy Security Board, Kerry Schott, who also served briefly as Chair of the NSW Net Zero Emissions and Clean Economy Board, said that she could not see a future without gas in the energy system:

> I'm perplexed how you can run a system [only] on renewables and batteries when you could have weeks of rain and can't recharge your batteries, and wind droughts.[2]

In February 2023, the Grattan Institute's energy programme director, Tony Wood, stated: 'We are kidding ourselves if we think we [can achieve net zero] without gas'.[3] Several months later, however, a report co-authored by Mr Wood himself contradicted his earlier statement, noting:

> Australia will not hit its 2050 net-zero emissions target unless it gets off natural gas … Victoria, the state that relies most on gas, will need to take 200 homes off gas every day until 2045 to achieve net zero. Governments need to start now.[4]

The Grattan Institute now urges rapid electrification: a process involving the switch from gas appliances and gasoline-based vehicles to electric devices and vehicles. As indicated above, the residential sector—namely, Australian families—will be expected to lead the way in bearing the burden of this process. Residential electrification involves not just replacing gas stovetops, gas heaters, and gasoline vehicles, but also installing batteries and the solar infrastructure needed to support the transition.

The Climate Council also sees no future for gas in Australia. It has recently launched a campaign directed at driving up household electrification, which was aptly named: *I Quit Gas*.[5]

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[1] Net Zero Australia, *Mobilisation report; How to make net zero happen* (July 2023) 1-71: https://www.netzeroaustralia.net.au/wp-content/uploads/2023/07/Net-Zero-Australia-Mobilisation-How-to-make-net-zero-happen-12-July-23.pdf.
[2] Mark Ludlow, 'States hit for "demonising gas"', *Australian Financial Review* (28 February 2023): https://www.afr.com/companies/energy/states-hit-for-demonising-gas-20230227-p5cnwf.
[3] Mark Ludlow, 'Victoria "kidding" itself if it excludes gas from energy transition,' *Australian Financial Review* (28 February 2023): https://www.afr.com/companies/energy/victoria-kidding-themselves-if-gas-excluded-from-energy-transition-20230228-p5co5x.
[4] Tony Wood, Alison Reeve, and Esther Suckling, 'Getting off gas: Why, how, and who should pay?' (Grattan Institute, 2023) 1-63.
[5] Climate Council, 'Sarah Wilson: I quit gas- and you can too!' accessed September 25 2023: https://www.climatecouncil.org.au/resources/i-quit-gas/; Climate Council, 'The future of gas is small and dwindling,' (9 June 2023): https://www.climatecouncil.org.au/resources/future-of-gas-is-small-and-dwindling; Carl Tidemann, Simon Bradshaw, Jennifer Rayner, and Dinah Arndt, *Smarter Energy Use: How to Cut Energy Bills & Climate Harm* (Climate Council, 2023): https://www.climatecouncil.org.au/wp-content/uploads/2023/04/CC_MVSA0353-CC-Report-Two-for-One-Home-Energy-Efficiency_V5.2-FA-Screen-Single.pdf.

Another campaign to drive up the rate of residential electrification was launched by independent senator, David Pocock, called *Suburb Zero*. Its aim is to pilot the rapid electrification of one Canberra suburb using taxpayer subsidies and concessional loans. A Parliamentary Budget Office (PBO) evaluation of this campaign estimated its direct cost to total at least $11,300 per eligible household over four years.[6] But this will not come even close to covering the full upfront cost of residential electrification for a family.

This report assesses the direct costs to households if the entire nation underwent full electrification, as well as the effects on the energy market resulting from economy-wide electrification. The analysis finds:

- The total cost of household electrification adds up to $81,054 per household.
- Nationwide household electrification could carry an aggregated annual cost of $28 billion between 2024 and 2050. The cumulative aggregated cost could be $768 billion over the 27 years to 2050.
- On a state-by-state basis, the aggregated upfront costs of electrification between 2024 and 2050 could potentially be
    - $246 billion in New South Wales, or $9.1 billion per annum.
    - $206 billion in Victoria, or $7.6 billion per annum.
    - $140 billion in Queensland, or $5.2 billion per annum.
    - $81 billion in Western Australia, or $3.0 billion per annum.
    - $57 billion in South Australia, or $2.1 billion per annum.
    - $18 billion in Tasmania, or $659 million per annum.
- The additional energy demand attributable to economy wide (residential and business) electrification will exceed the total amount of electricity generated by sources that are reliable and available, such as coal and gas, by 2037.
- Electricity consumption attributable to electrification in the National Electricity Market (NEM) is expected to increase to 121 TWh per annum by 2050. Generation by reliable and available sources is forecast to be 58 TWh per annum by 2050. The generation deficit, attributable solely to electrification, will therefore reach 63 TWh per annum—enough to power more than seven million Australian homes for a year.

The implication of these findings is that Australians will be more dependent on intermittent renewables and experimental batteries to power their homes and businesses.

The concerted effort to electrify homes and industries in Australia will serve to further disincentivise investment in gas exploration and production by artificially reducing market demand. This comes at a time when more gas production is needed to deliver energy into homes and to support the electricity market that is fast losing baseload power and becoming inundated by intermittent renewables.

[6] Parliamentary Budget Office, *Policy costing: Suburb Zero pilot in the ACT* (1 September 2022).

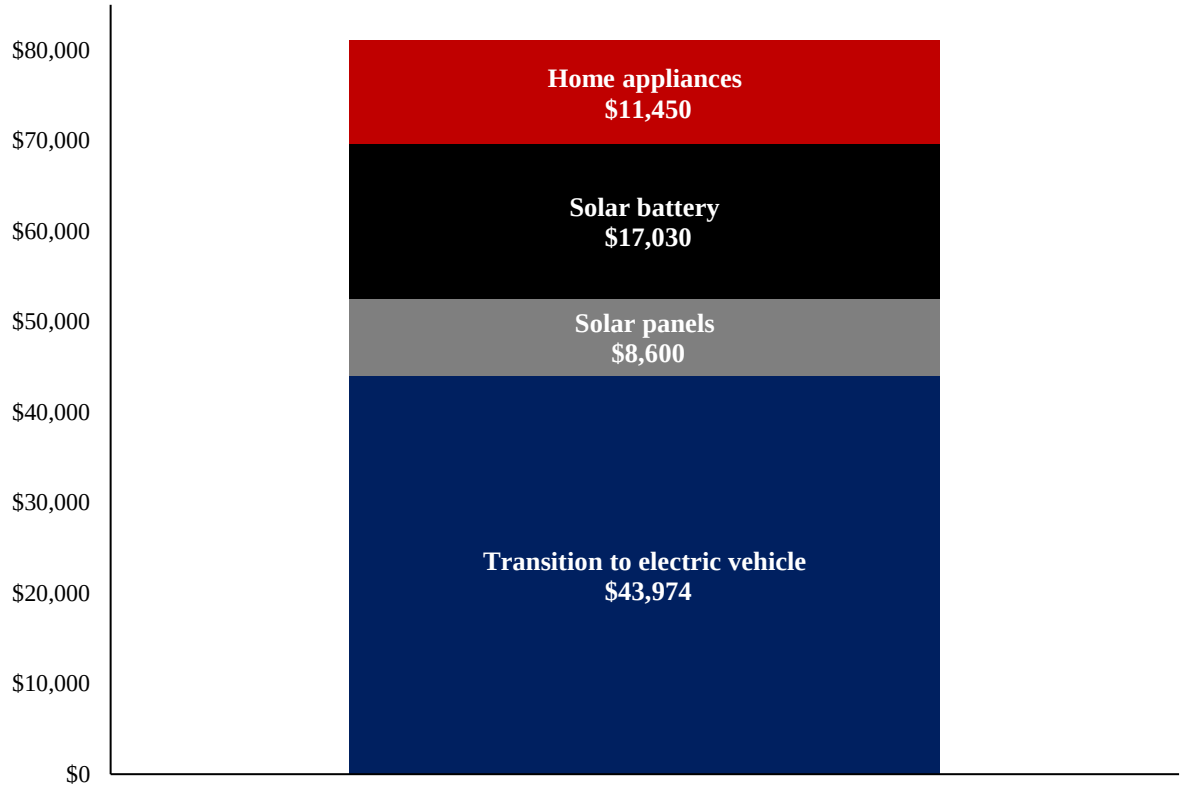
The cost of residential electrification

The total upfront cost of residential electrification is estimated to add up to $81,054 per household. Consistent with Senator Pocock's *Suburb Zero* electrification roadmap, the cost is broken up into four components, namely:

- the transition from combustion engine to electric vehicles;
- the installation of a 6.6 kW set of solar panels;
- the installation of a 13 kWh solar battery; and
- the replacement of gas appliances with electric appliances.[7]

Even homes without a gas connection will be burdened by the upfront cost of electrification—albeit by a smaller amount—totalling approximately $69,604 per household. This is because electrification requires more than just replacing household gas appliances, but also replacing combustion engine vehicles with electric vehicles—and installing the solar infrastructure needed to support the residential electrification project without which the electricity grid (including transmission lines) will be placed under further stress, resulting in an additional risk of collapse.

Chart 1: Market price of residential electrification, by component, per household



Source: IPA, Net Zero Australia

[7] The costing for each component is based on data from Net Zero Australia and Solar Choice. Net Zero Australia, *Mobilisation report; How to make net zero happen* (July 2023), 57,; Solar Choice, 'Solar Battery Costs: Solar Battery Price Index' (1 August 2023): https://www.solarchoice.net.au/solar-batteries/price/.

The total upfront cost of full household electrification in Australia—covering the close to 11 million homes across the nation—is estimated to add up to $768 billion.[8] If full household electrification is to be achieved by 2050 in order to meet the Net Zero emissions target, the annual cost over the next 27 years will be approximately $28 billion.

Table 1: Aggregate cost of household electrification in Australia

Cost component	Cost per household	Affected households	Aggregate cost	Annual cost out to 2050
Electric vehicle transition	$ 43,974	10,541,125	$ 463.54 bn	$17.17 bn
Solar panels	$ 8,600	7,556,250	$ 64.98 bn	$2.41 bn
Solar batteries	$ 17,030	10,576,250	$ 180.11 bn	$6.67 bn
Gas home appliances	$ 11,450	5,163,000	$ 59.11 bn	$2.19 bn
		Total	$ 767.75 bn	$28.44 bn

Source: IPA, PBO, Net Zero Australia, Energy Networks Australia

The abovementioned estimate of the cost of full nation-wide residential electrification was derived by multiplying the cost of each component of electrification by the number of affected homes across the country.

For instance: approximately 48 per cent of homes in Australia are connected to gas, amounting to a total of 5.16 million homes requiring new electric appliances.[9] More than 12 million household appliances are currently connected to a gas network. Approximately 3.2 million Australian homes already have solar panels, leaving around 7.56 million homes requiring solar panel installations.[10] Roughly 180,000 homes are equipped with solar batteries according to a report SunWiz,[11] and an estimated 2 per cent of Australian households own an electric vehicle,[12] meaning that the overwhelming majority of homes in Australia still need to transition to electric vehicles and install solar batteries to achieve full residential electrification.

Any public subsidy will only be able to cover a small portion of the cost. Moreover, taxpayer subsidies will need to be repaid by way of increased taxation in the future and/or reduced government services, meaning households will pay either way for electrification.

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[8] This is the equivalent to $71,377 per household. The amount is less than the estimated full cost of electrification (at $81,054) because some dwellings do not need full electrification (e.g., some households undergoing electrification may not be connected to gas and do not need to incur that cost component).
[9] Energy Networks Australia, *Reliable and clean gas for Australian homes* (July 2021) 2: https://www.energynetworks.com.au/resources/fact-sheets/reliable-and-clean-gas-for-australian-homes-2/.
[10] Roy Morgan, 'Solar Energy Systems on households more than doubled since 2018 – now at nearly a third of all households (32.2%)' (Article No. 9091, 18 October 2022) 1: https://www.roymorgan.com/findings/9091-solar-energy-systems-on-households-more-than-double-since-2018-now-at-nearly-a-third-of-all-households.
[11] Daniel Mercer, 'Household battery uptake surges to record high amid market turmoil, rocketing prices', *ABC News* (30 March 2023): https://www.abc.net.au/news/2023-03-30/australian-household-battery-uptake-surges-to-record-high/10216013/; SunWiz, *Battery Market Report Australia 2023* (2023): https://www.sunwiz.com.au/battery-market-report-australia-2023/.
[12] Australian National University, 'Electric vehicles remain out of reach for many', *What Australia Thinks* (17 April 2023): https://whataustraliathinks.org.au/data_story/electric-vehicles-remain-out-of-reach-for-many/; Electric Vehicle Council, *Australian Electric Vehicle Industry Recap* (2023) 3.

State by state breakdown of national electrification costs

In New South Wales, the state which boasts the largest population and host of 3.47 million homes, the total cost of residential electrification could add up to $246.91 billion. The annual cost between now and 2050 is estimated to be $9.14 billion.

Table 2: Aggregate cost of household electrification in NSW

Cost component	Affected households	Aggregated cost
Electric vehicle transition	3,398,093	$149.43 bn
Solar panels	2,582,442	$22.21 bn
Solar batteries	3,417,661	$58.20 bn
Gas home appliances	1,491,000	$17.07 bn
	Total	$246.91 bn
	Annual cost to 2050	$9.14 bn

Source: IPA, PBO, Net Zero Australia, Energy Networks Australia

In Victoria, the state which boasts the second largest population (with 2.75 million homes) and the greatest number of homes connected to gas, the total cost of residential electrification could add up to $205.86 billion. The annual cost between now and 2050 is estimated to be $7.62 billion.

Table 3: Aggregate cost of household electrification in Victoria

Cost component	Affected households	Aggregated cost
Electric vehicle transition	2,693,711	$118.45 bn
Solar panels	2,020,684	$17.38 bn
Solar batteries	2,707,734	$46.11 bn
Gas home appliances	2,089,000	$23.92 bn
	Total	$205.86 bn
	Annual cost to 2050	$7.62 bn

Source: IPA, PBO, Net Zero Australia, Energy Networks Australia

In Queensland, the state with the third largest and—until recently—the fastest-growing population in Australia (and 2.11 million homes), the total cost of residential electrification could add up to $140.20 billion. The annual cost between now and 2050 is estimated to be $5.19 billion.

Table 4: Aggregate cost of household electrification in Queensland

Cost component	Affected households	Aggregated cost
Electric vehicle transition	2,067,800	$90.93 bn
Solar panels	1,354,000	$11.64 bn
Solar batteries	2,067,475	$35.21 bn
Gas home appliances	211,000	$2.42 bn
	Total	$140.20 bn
	Annual cost to 2050	$5.19 bn

Source: IPA, PBO, Net Zero Australia, Energy Networks Australia

In South Australia, the state with arguably the most vulnerable electricity grid, due to the absence of any coal-fired power station, the total cost of residential electrification to its 803,000 households could add up to $57.20 billion. The annual cost between now and 2050 is estimated to be $2.12 billion.

Table 5: Aggregate cost of household electrification in South Australia

Cost component	Affected households	Aggregated cost
Electric vehicle transition	787,500	$34.63 bn
Solar panels	471,571	$4.06 bn
Solar batteries	784,896	$13.37 bn
Gas home appliances	450,000	$5.15 bn
	Total	$57.20 bn
	Annual cost to 2050	$2.12 bn

Source: IPA, PBO, Net Zero Australia, Energy Networks Australia

In Western Australia, the state with the most isolated energy system, made up of disconnected gas and electricity networks, the total cost of residential electrification to its 1.11 million households could add up to $80.98 billion. The annual cost between now and 2050 is estimated to be $3.00 billion.

Table 6: Aggregate cost of household electrification in Western Australia

Cost component	Affected households	Aggregated cost
Electric vehicle transition	1,090,971	$47.97 bn
Solar panels	674,235	$5.80 bn
Solar batteries	1,088,542	$18.54 bn
Gas home appliances	757,000	$8.67 bn
	Total	$80.98 bn
	Annual cost to 2050	$3.00 bn

Source: IPA, PBO, Net Zero Australia, Energy Networks Australia

Finally, in Tasmania, the state which pays the most for its electricity, the total cost of residential electrification to its 260,000 households could add up to $17.78 billion. The annual cost between now and 2050 is estimated to be $658.60 million.

Table 7: Aggregate cost of household electrification in Tasmania

Cost component	Affected households	Aggregated cost
Electric vehicle transition	254,800	$11.20 bn
Solar panels	235,400	$2.02 bn
Solar batteries	258,616	$4.40 bn
Gas home appliances	13,000	$148.85 mn
	Total	$17.78 bn
	Annual cost to 2050	$658.60 mn

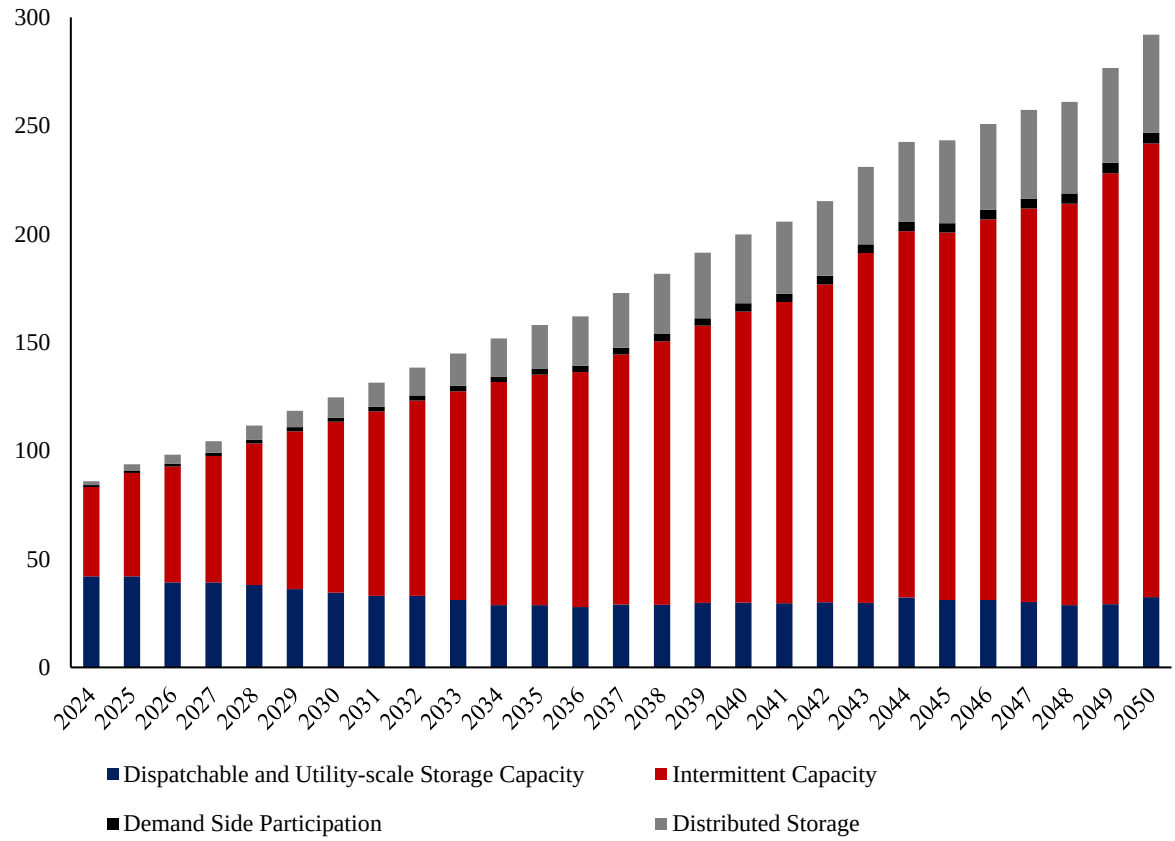
Source: IPA, PBO, Net Zero Australia, Energy Networks Australia

Firm generation deficit due to electrification

The installation of batteries and photovoltaic cells is essential to electrification because replacing gas-powered and gasoline-powered vehicles, appliances, and machineries—in the context of a transition to renewable energy—contributes to the creation of 'firm generation deficit', namely, an excess of electricity demand over and above what can be provided by reliable and controllable electricity generators and utility-scaled storage mechanisms.

As illustrated in Chart 2, according to the Australian Energy Market Operator's (AEMO) step change scenario, dispatchable capacity in the NEM is set to decline from 41.98 GW in the financial year ending 2024 to 32.47 GW by the financial year ending 2050. This represents a 22.65 per cent decline.[13]

Chart 2: National Electricity Market grid composition (GW)



Source: AEMO, IPA

But the problem that the grid will face in the next three decades is significantly more severe. Baseload capacity is set to decline by 100 per cent—from 21.28 GW to nil by 2043—within less than a decade. Gas and liquid fuel generation capacity is set to decline by 21.82 per cent from 12.33 GW this financial year to 9.64 GW by 2050. Traditional hydroelectric capacity will remain roughly the same at around 7 GW because, according to Geoscience Australia: 'Much of Australia's economically feasible hydro energy source has already been

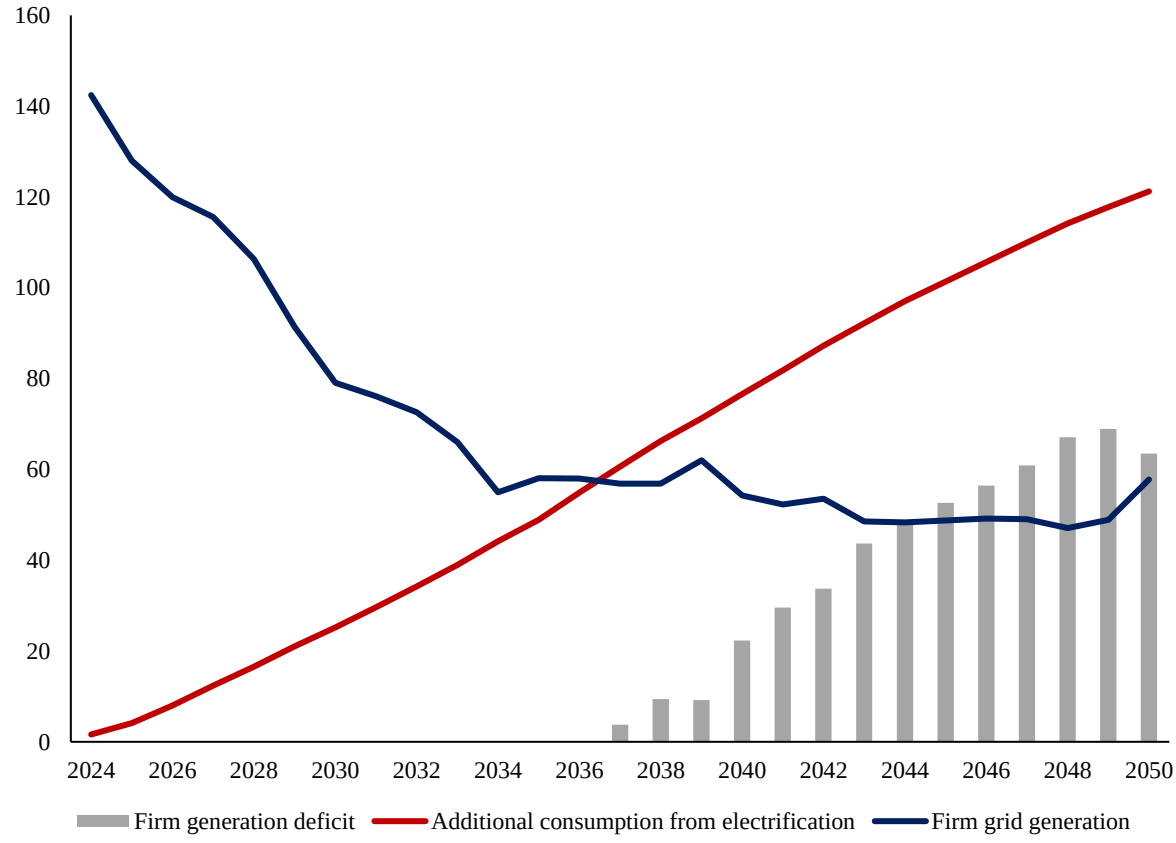
[13] Australian Energy Market Operator (AEMO), *2022 Integrated System Plan* (2022) 9: https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp.

harnessed'.[14] The largest component of the NEM's firm capacity by 2050, therefore, will be made up of utility-scaled storage facilities such as batteries and pumped hydro.

The effect of the decline in firm capacity, in light of the increasing electricity demand over the next 27 years to 2050—based on AEMO's electrification roadmap—is reflected in Chart 3 which tracks the sharp decline in firm grid generation output over the coming decade to the financial year ending 2034, followed by a more steady but continuous decline in firm grid generation output to 2050.[15]

Electricity consumption attributable to electrification, on the other hand, is expected to increase largely at a constant rate to 121.22 TWh per annum by 2050—the equivalent to over half of the NEM's annual output today of around 200 TWh. Firm generation is forecast to be 57.76 TWh by 2050. The firm generation deficit, attributable solely to electrification, will therefore reach 63.47 TWh by 2050 – enough energy to power more than 7 million homes for a year.

Chart 3: Firm generation deficit in the National Electricity Market due to increased demand from electrification (TWh)



Source: IPA, AEMO

[14] Geoscience Australia, 'Hydro Energy' (7 June 2023): https://www.ga.gov.au/scientific-topics/energy/resources/other-renewable-energy-resources/hydro-energy.
[15] AEMO, *2022 Final ISP Results Workbook – Step Change* (2022) https://aemo.com.au/-/media/files/major-publications/isp/2022/2022-documents/generation-outlook.zip?la=en; AEMO, 'Electrification (TWh)' in *2023 IASR Assumptions Workbook* (2023): https://aemo.com.au/-/media/files/major-publications/isp/2023/2023-iasr-assumptions-workbook.xlsx?la=en.

The effect of an increased firm generation deficit is that families, businesses, the public service, and civil society organisations will be more reliant on intermittent sources of power, distributed storage facilities, as well as demand side participation programmes—arrangements by which electricity users must reduce their consumption at times of high wholesale prices or emerging reliability issues.

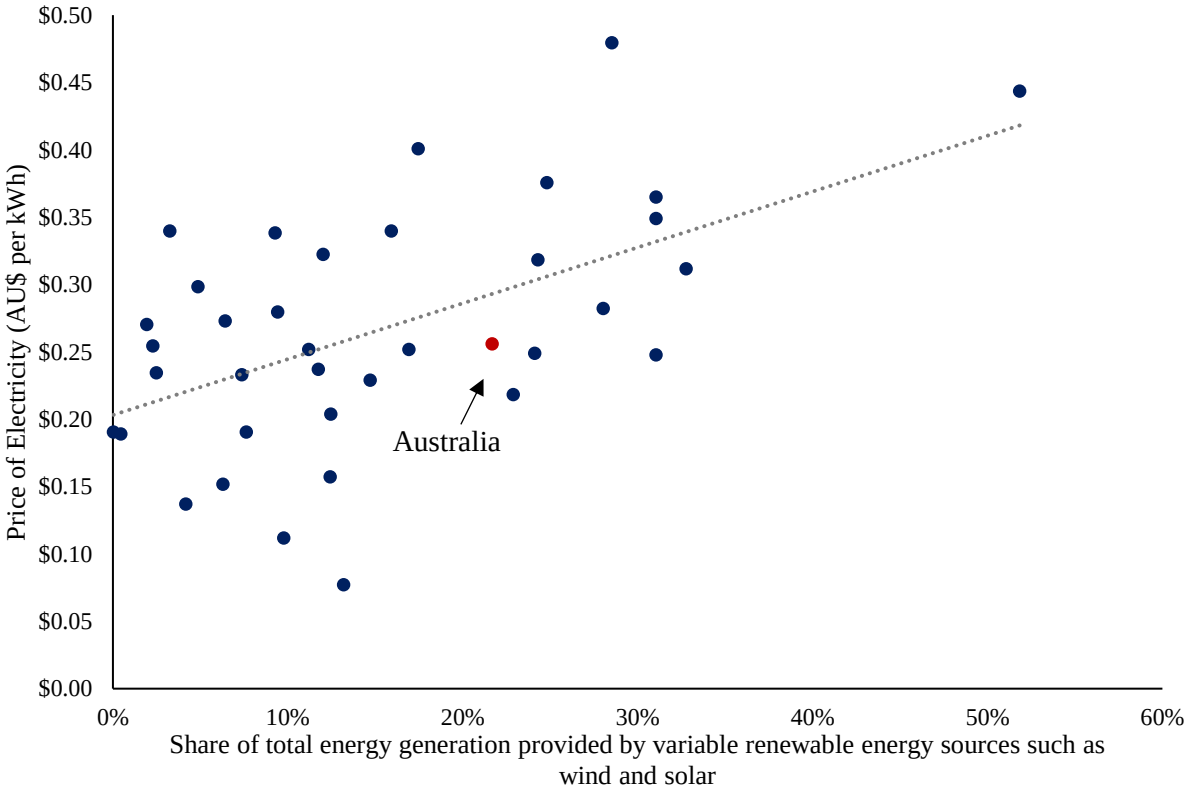
Australia's energy infrastructure is already struggling

IPA research released in May 2023 criticised the much publicised levelised cost of electricity (LCOE) measure, which assesses the financial cost of an independent generating asset—like a renewable power station—devoid of any consideration of the alterations necessary to the network in order to accommodate its integration.[16]

These include the addition of synchronous condensers, construction of storage mechanisms like lithium batteries, and construction of additional interconnectors to parts of the electricity grid better served by baseload power stations.

The cost of producing electricity from a solar or wind farm may be lower on an LCOE basis per MWh, but this estimate is only one part of the total system cost of plugging renewable energy sources into the grid. This is the reason that the more a nation relies on renewable energy, the more its residents must pay for electricity, as shown in Chart 4.

Chart 4: Reliance on variable renewable energy vs retail electricity prices in the OECD



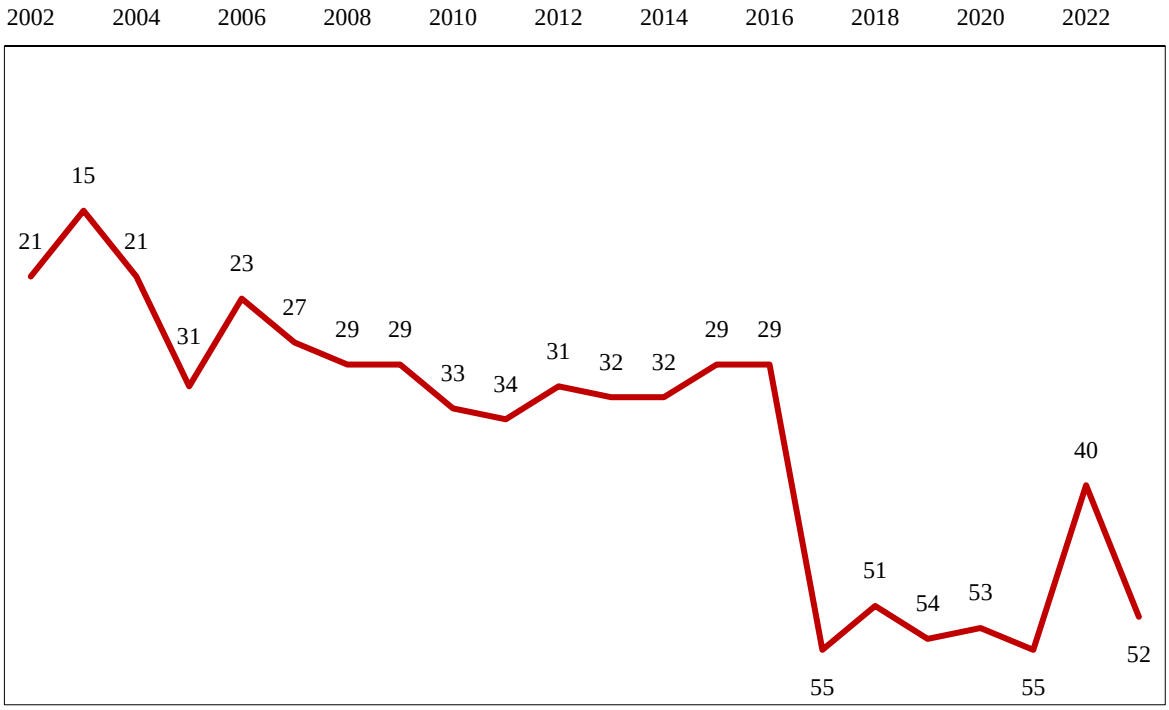
Source: AEC, BP, IPA

[16] Scott Hargreaves, Daniel Wild and Kevin You, *Liddell The Line In The Sand: Why It's Time to Hit Pause on the Closure of Coal-Fired Baseload Power Stations in the NEM* (Institute of Public Affairs Report, 2023).

Accommodating the surge of variable renewable energy sources in Australia's electricity grid necessitates considerable investment. Currently, the quality of Australia's electricity infrastructure is a cause for concern. Australia's energy generating facilities and transmission networks are struggling to keep up with the rapid increase in variable sources while also failing to cope with net zero-induced underinvestment in baseload power facilities. They are also experiencing a decline in performance, as wind and solar continue to increase their share in energy generation and installed capacity.

Chart 5 illustrates Australia's declining energy infrastructure ranking over the last two decades, since 2002, when the International Institute for Management Development's World Competitiveness Centre started collecting survey data regarding the adequacy and efficiency of energy infrastructure around the world.

Chart 5: Australia's energy infrastructure ranking



Source: IMD, IPA

The latest survey, released in 2023, ranks Australia 52nd out of the 64 participating economies, just behind Botswana, Estonia, Latvia, and Kazakhstan. France, which generates 68 per cent of its electricity from nuclear power, is ranked 12th in the world. China, the world's largest consumer of coal-powered electricity, is ranked 8th. The United Arab Emirates (UAE) is ranked first.

The UAE's abundance of oil reserves plays a role in both the quality of and market confidence in its energy infrastructure, in the sense that investors, and the capital needed to build energy infrastructure, are attracted to nations with a lot of reserves on which to capitalise. But reserves volume is not determinative of infrastructure capital, quality, and adequacy. Venezuela, the country with the largest oil reserves in the world is ranked second last, ahead of South Africa.

More important than the natural resources available within a territorial border is what government and private institutions do with its domestic and imported supply of natural resources.

The state of Victoria, for example, has access to rich gas basins in the Gippsland and Otway-Bass regions. The potential for unconventional gas extraction is particularly promising. In 2022, the IPA highlighted that:

> According to Geoscience Australia, in the Gippsland Basin alone, there are 19.2 trillion cubic feet of unconventional natural gas. That is equivalent to 879 million petajoules, which could power every home in Australia for the next 94 years![17]

But the Victorian state government currently has in place a constitutional ban on fracking, which blocks access to the valuable gas resources in its own backyard: gas that could be used to provide affordable energy to Victorian families. Rather, the state government has criticised the use of gas and announced a ban on gas connections in new homes starting from January 2024 as a part of its electrification programme.[18]

The cost of the network alterations that will be needed to accommodate Victoria's electrification drive is estimated to add up to $11.34 billion.[19]

Without considerable capital investment in upgrading Victoria's and Australia's extensive electricity networks, electrification will further jeopardise the integrity, efficiency, and performance of Australia's existing networks.

Electrification lacks adequate justification

The touted justification for taking gas appliances away from Australian households is twofold. The first is that full electrification reduces greenhouse gas emissions. The second is that replacing gas appliances will end up being cheaper for consumers.

The aggregate upfront cost of replacing the 12 million gas network-connected appliances of the 5.16 million gas-connected homes in Australia would total just over $59 billion. The argument that this will end up being cheaper for consumers in the long run is inconsistent with the notion that the transition should be managed and, in some instances, enforced by the government. If consumers truly benefit from electrification, then no government subsidies and mandates would be necessary to entice households to electrify their homes.

[17] Saxon Davison, 'Voters must say no to Labor's naïve plan to make Victoria nearly totally reliant on green energy by 2035', *Sky News Australia* (21 November 2022): https://ipa.org.au/ipa-today/voters-must-say-no-to-labors-naive-plan-to-make-victoria-nearly-totally-reliant-on-green-energy-by-2035.
[18] Adeshola Ore, 'Victoria announces ban on gas connections to new homes from January 2024', *The Guardian* (28 July 2023): https://www.theguardian.com/australia-news/2023/jul/28/victoria-announces-ban-on-gas-connections-to-new-homes-from-january-2024.
[19] This estimation was calculated with estimates regarding the electricity network cost and the cost of the once off gas to electricity switch, see Tony Wood and Guy Dundas, *Flame out: The future of Natural Gas – Chart Data* (Grattan Institute, 2020) Figure 5.4 – Present Value $ Million: https://grattan.edu.au/wp-content/uploads/2020/11/Flame-out-report-chart-data.xlsx.

If the only barrier to electrification is the high upfront cost, then providing loans for electrification should be left to the financial sector rather than the public sector. Moreover, no Victoria-style gas ban should be necessary.

Regarding CO_2 emissions from gas: modelling by the Grattan Institute suggests full electrification in Melbourne, the city with the highest rate of gas connections in Australia, will in fact increase—not decrease—annual greenhouse gas emissions. Annual emissions from heating, cooking and hot water are set to rise from 2.83 tonnes to 3.43 tonnes per household under a full electrification scenario.

The reason fully electrified homes and appliances produce more emissions is because burning the fuel mix that is used to produce electricity, results in the production of more CO_2 and CO_2 equivalent (CO_2-e) emissions than burning gas—especially in Victoria, where the main source of baseload power is the more affordable but higher-emission brown coal as opposed to black coal.

The combustion of each kWh of gas emits roughly 0.19 kg of CO_2-e.[20] In Victoria, electricity generation emits 0.85 kg CO_2-e per kWh.[21] Nationwide, electricity generation emits 0.68 kg CO_2-e per kWh of energy. Only in Tasmania, with its abundance of hydroelectricity, are emissions from electricity generation lower than 0.19 kg of CO_2-e per kWh.

Table 8: Carbon dioxide equivalent emitted per kilowatt hour of electricity produced

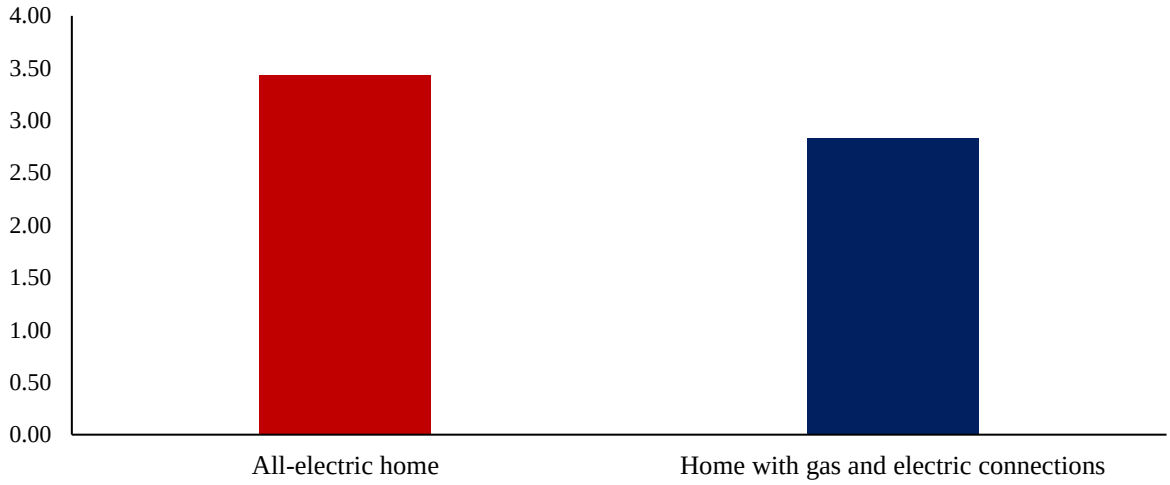
Transmission network	Emissions from electricity generation
NSW and ACT	0.73 kg CO_2-e per kWh
Victoria	0.85 kg CO_2-e per kWh
Queensland	0.73 kg CO_2-e per kWh
WA (North)	0.58 kg CO_2-e per kWh
WA (South)	0.51 kg CO_2-e per kWh
South Australia	0.25 kg CO_2-e per kWh
Tasmania	0.17 kg CO_2-e per kWh
Northern Territory	0.54 kg CO_2-e per kWh
National	**0.68 kg CO_2-e per kWh**

Source: DCCEEW

Even accounting for the purported higher efficiency of electric stoves, ovens, heaters and hot water tanks, household emissions in Melbourne would still be higher in an all-electric home compared to a dual-fuel home. Household electrification, therefore, does not reduce emissions, at least in the immediate term.

[20] Tristan Edis, 'The two facts to consider before writing off Dictator Dan's gas ban', *Australian Financial Review* (2 August 2023): https://www.afr.com/policy/energy-and-climate/the-two-facts-to-consider-before-writing-off-dictator-dan-s-gas-ban-20230802-p5dtae.
[21] Department of Climate Change, Energy, the Environment, and Water, *Australian National Greenhouse Accounts Factors*: *For individuals and organisations estimating greenhouse gas emissions* (Commonwealth of Australia, 2023) 7: https://www.dcceew.gov.au/sites/default/files/documents/national-greenhouse-accounts-factors-2022.pdf

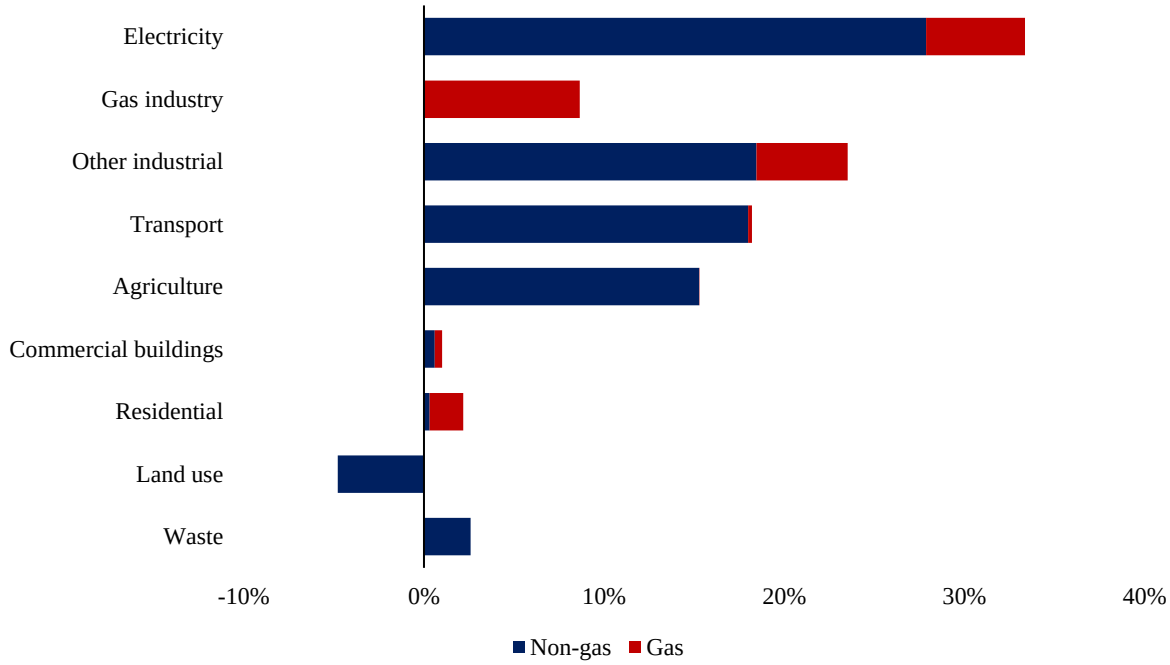
Chart 6: Estimated emissions in 2023 (tCO_2-e) from heating, cooking and hot water in Melbourne



Source: Grattan Institute

Carbon emissions from the use of residential gas appliances make up only 1.86 per cent of total nationwide emissions. And only about 21.69 per cent of Australia's emissions come from the production and burning of natural gas.[22] Even when emissions from sources other than the production and burning of gas are taken out of the equation, households are only responsible for 8.58 per cent of all emissions attributable to gas.

Chart 7: Share of carbon dioxide equivalent emissions in 2020, by sector



Source: Grattan Institute

[22] Tony Wood, Alison Reeve and Esther Suckling, *Getting off gas: Why, how, and who should pay?* (Grattan Institute, June 2023) 8: https://grattan.edu.au/wp-content/uploads/2023/06/Getting-off-gas-why-how-and-who-should-pay.pdf.

The justification for pursuing a residential electrification campaign is measurably inadequate. A concerted electrification programme will serve to further disincentivise investment in gas exploration and production, at a time when more gas is needed more than ever.

Conclusion

Nationwide electrification will add unnecessary stress to Australia's already struggling electricity generation and distribution networks. It will further disincentivise investment in gas exploration and production, at a time when more gas than ever is needed to add stability to the energy market. And it will cost households directly, and taxpayers indirectly through subsidies, more than three-quarters of $1 trillion or $28 billion per annum between now and 2050.

There is no sufficient justification for pursuing residential or economy-wide electrification. Electrification ought to be abandoned in favour of policies which prioritise affordable and reliable energy for Australian families and businesses.

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