ELECTRIFY
BOROONDARA

Let's electrify our community

• Save money • Improve health and comfort • Safer climate

Electrify Boroondara Alliance

Going Electric


Climate action is our most urgent task for our kids' future
Make the switch from fossil gas to electricity!

Why go electric?

- Save money
- Better health and comfort
- Create a safer climate

ELECTRIFY BOROONDARA

Contents

ELECTRIFY
BOROONDARA

Electrify Boroondara is an alliance of community groups empowering our community to

- Increase the uptake of **rooftop solar** and **batteries**
- Reduce the use of fossil gas by **transitioning to electric appliances**
- Increase the uptake of **electric vehicles** and **ebikes**
- Improve the **energy efficiency** of all buildings in our community

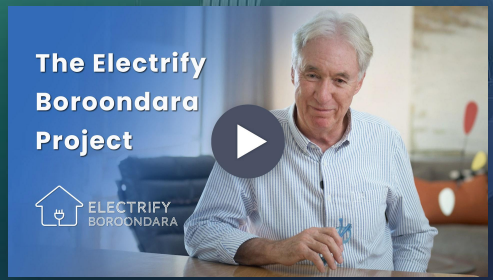
Visit electrifyboroondara.org

Electrify Boroondara Alliance

Electrify Boroondara - engaging with Boroondara Council

Boroondara's Climate Action Plan (p. 21) sets out ambitious targets:

- **60% emissions reduction** by 2030 across Boroondara
- **Carbon neutrality by 2035**
- **50,000kW additional solar by 2030** (tripling community-wide solar)



Achieving these targets will require substantial community engagement

Electrify Boroondara will accelerate our clean energy transition:

- check out Cr Wes Gault's supportive statements on the Electrify Boroondara YouTube channel

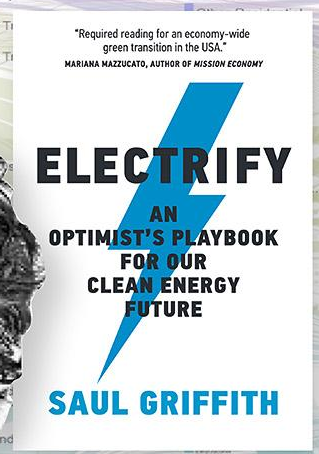
Let’s look at how we use energy

Saul Griffith

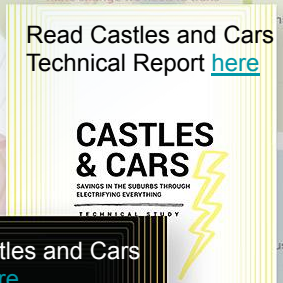
Read Electrification is Anti-inflationary here

More about Super Sankey here

Read Electrify here

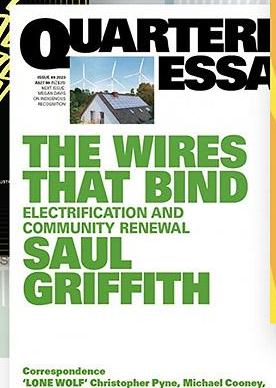


Read Castles and Cars Technical Report here

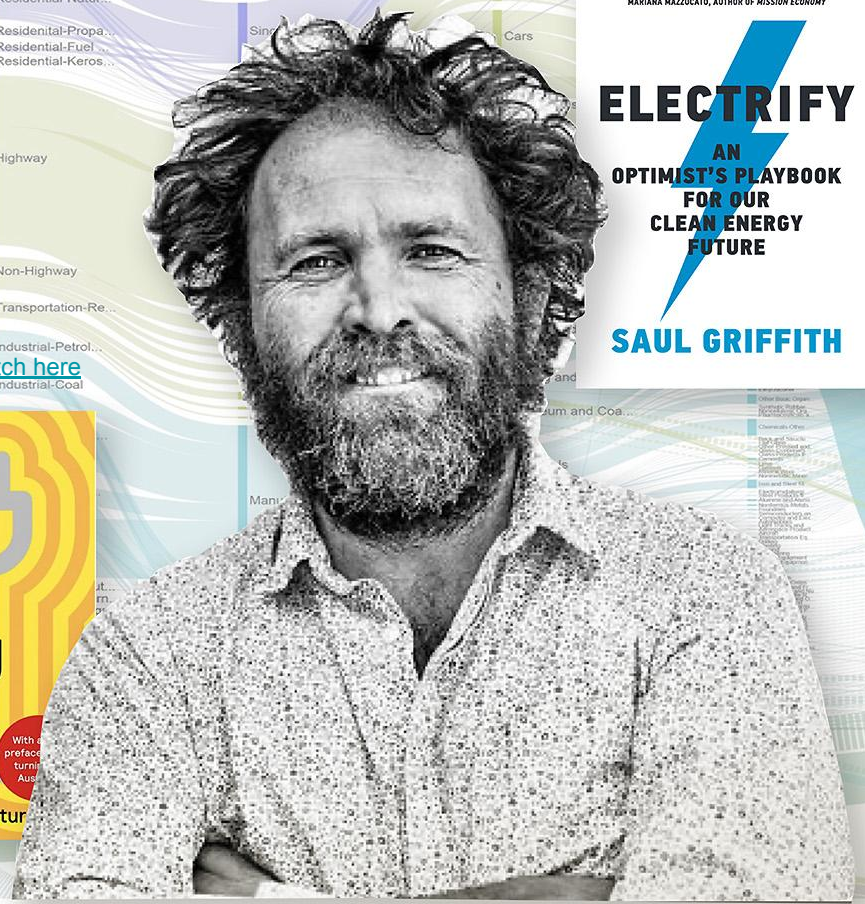


Read Castles and Cars Report here

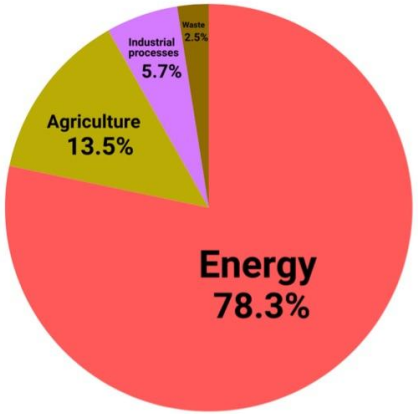
Read The Wires That Bind here



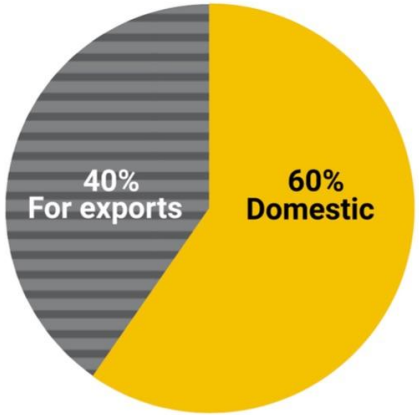
Read The Big Switch here



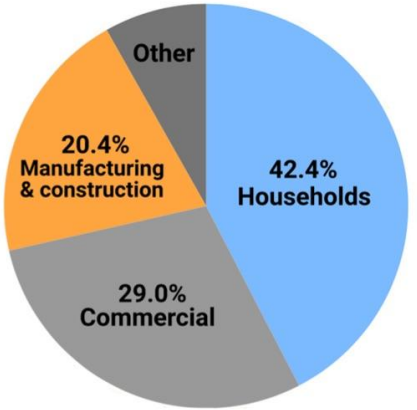
Energy usage, especially household energy usage, is a good place to start to reduce Australia's emissions



The majority of Australia's emissions are from energy use.



40% is used in making exports. 60% is the result of our daily lives in Australia.



Households create more emissions than business or manufacturing.

Graphs from Rewiring Australia's home page

Adapated from Rewiring Australia

ELECTRIFYING
AUSSIE HOUSEHOLDS IS THE KEY

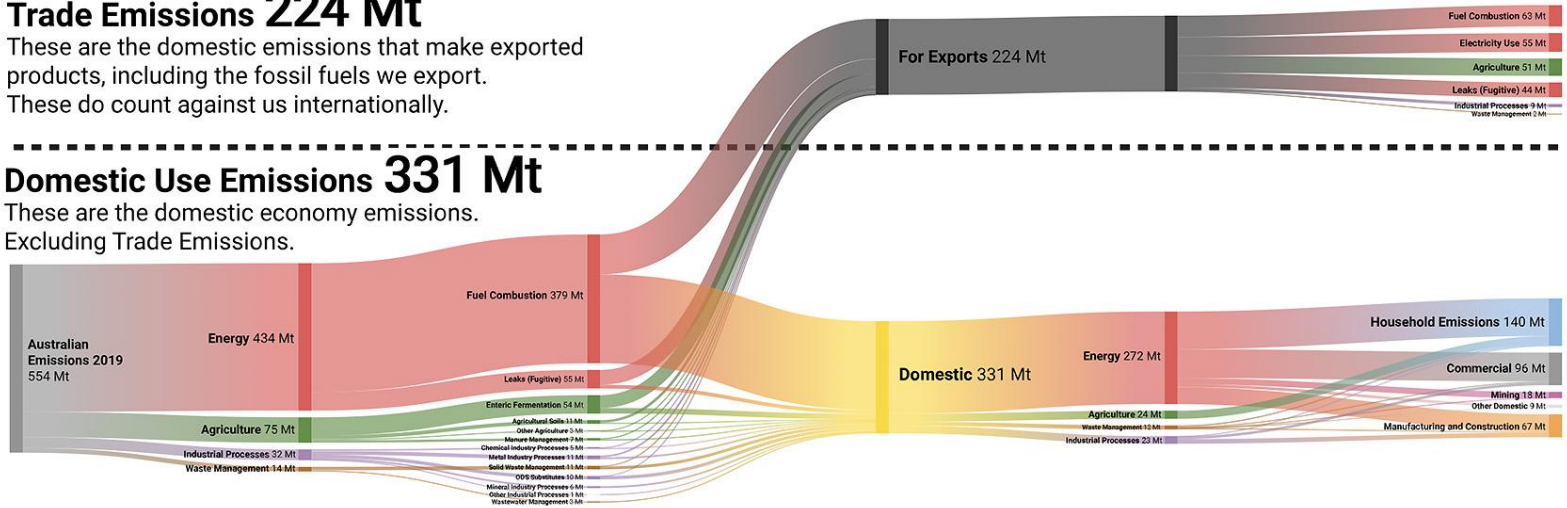
Castles and Cars :
Savings in the suburbs
through electrifying everything

Rewiring Australia

Total Reported Emissions 554 Mt
These are the total emissions reported.

Trade Emissions 224 Mt
These are the domestic emissions that make exported products, including the fossil fuels we export.
These do count against us internationally.

Domestic Use Emissions 331 Mt
These are the domestic economy emissions.
Excluding Trade Emissions.



Graph from Saul Griffith's Castles and Cars Report for Rewiring Australia p. 8

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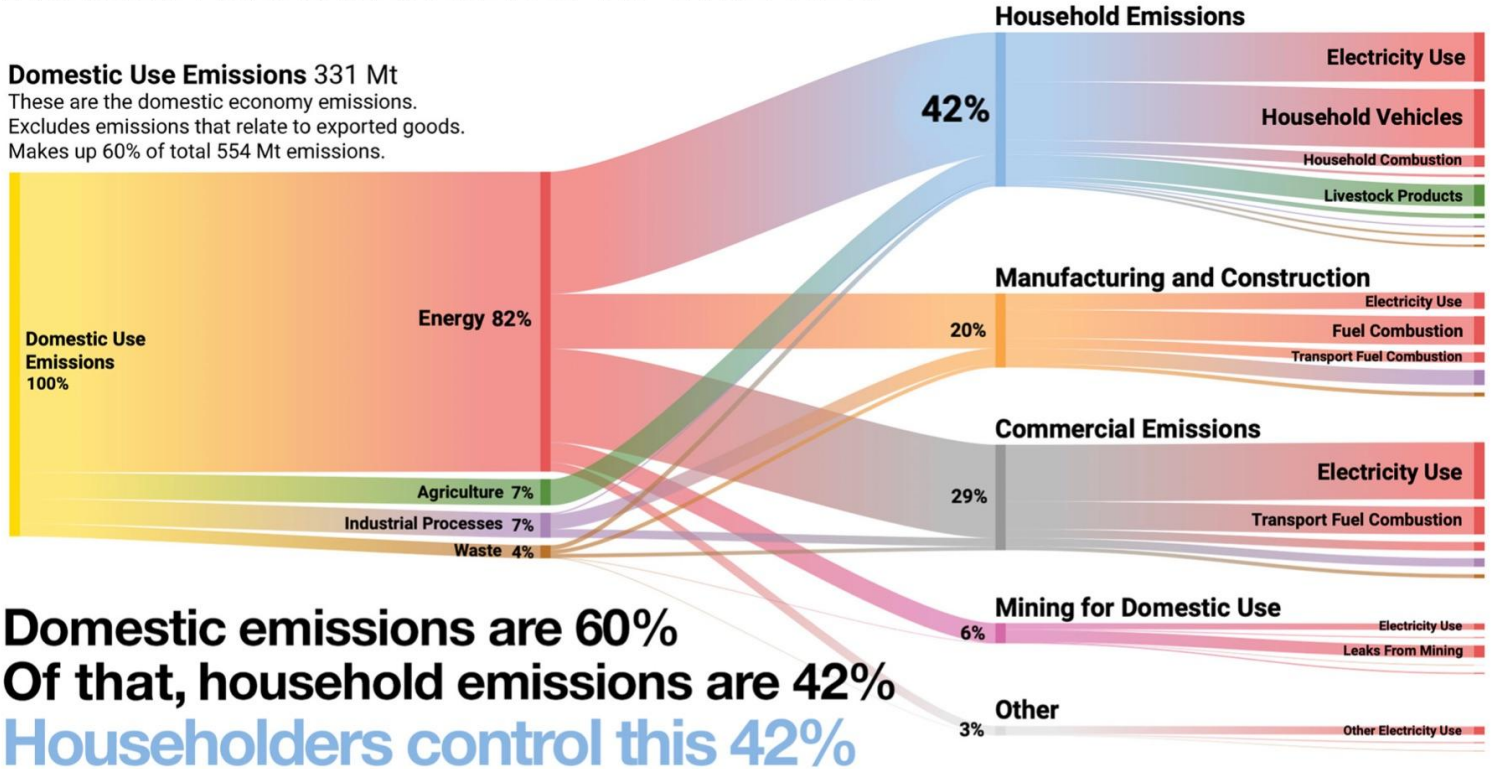
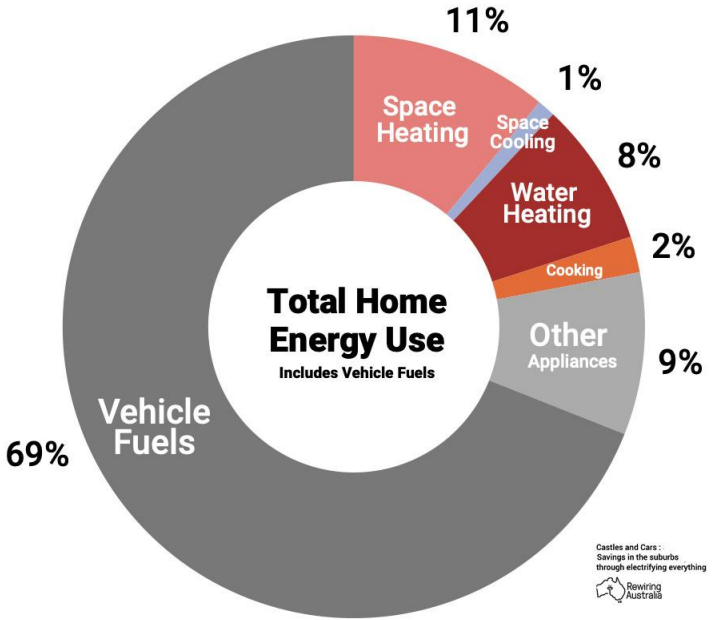


Domestic emissions are 60%
Of that, household emissions are 42%
Householders control this 42%

Graph from Saul Griffith's Castles and Cars Report for Rewiring Australia p. 8

How do Australian households use energy?

- Household energy use is the energy use that we control
- Electrification is a major pathway to sustainable energy use
- Electrification, especially with rooftop solar, improves household resilience and energy independence



Graph of an “average” conventional gas and petrol household’s energy usage from Saul Griffith’s Castles and Cars Report for Rewiring Australia p. 10, with more information in the accompanying technical report, pp. 8-10, Victorian data pp. 30-34.

Saul Griffith: (p. 10) “The “average” Australian household currently uses ~102kWh of energy per day, and spends $5,248 per year on energy related costs. **Much of this energy use is due to the inefficiency of conventional fuels like natural gas and petrol for cars**, which also create a large amount of emissions.”

Why should we go electric?

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AUSSIE HOUSEHOLDS IS THE KEY

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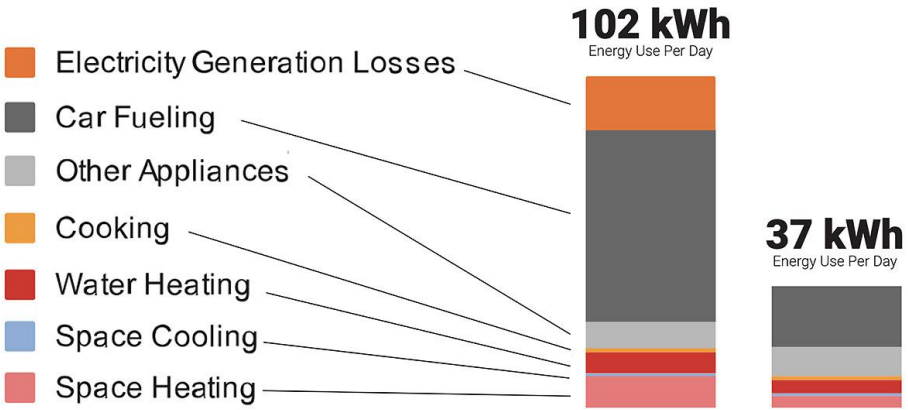
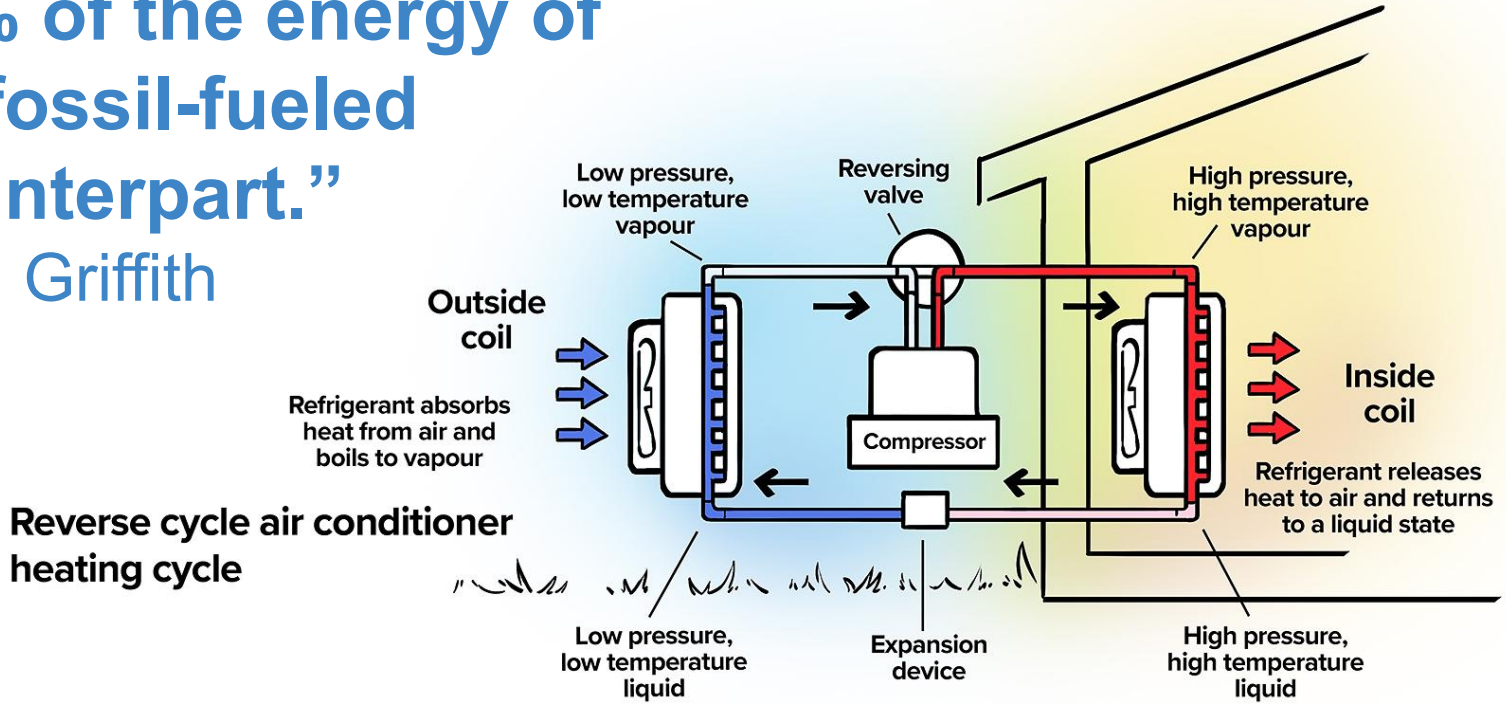


"without any of the traditional efficiency measures … an Electrify Everything strategy will **reduce** the primary energy consumption of the average Australian household **by around 60%**" Saul Griffith pp. 6-7

Graph from Saul Griffith's Castles and Cars Report for Rewiring Australia p. 9, data explained in accompanying technical report, pp. 8-10.
"Australian households average 14kWh of electricity use today, 31kWh when the average thermoelectric losses [from generation] are accounted for." Adding petrol and diesel "brings the daily total to 102kWh."
In contrast a fully electrified home requires "only 37kWh of electricity."
Corresponding figures for Victoria can be found in the Technical Report pp. 30-33, corresponding graph is Fig 3.26, p. 31. In Victoria a conventional household uses 120 kWh per day dropping to 42kWh for an electrified household - the annual savings are only slightly less than national figures.

“A fully electrified home powered by renewables will need less than 40% of the energy of its fossil-fueled counterpart.”

Saul Griffith

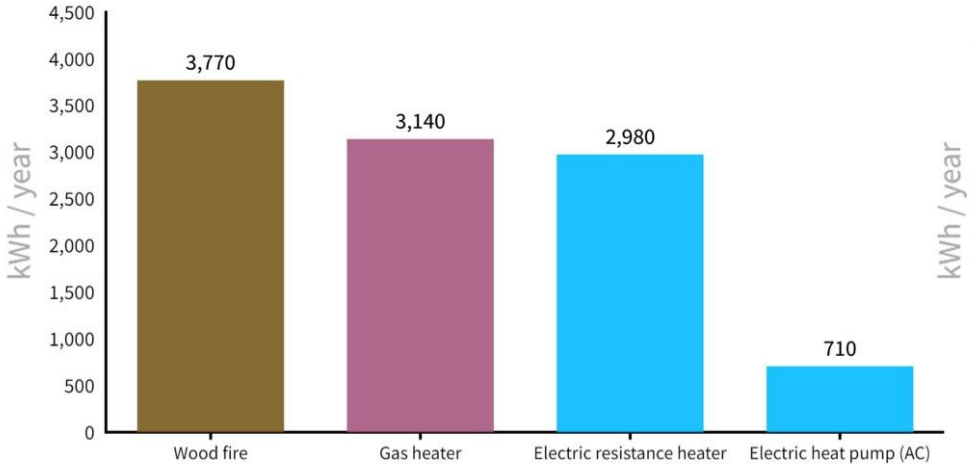


Quote from Saul Griffith’s Castles and Cars Report for Rewiring Australia p. 11

A) Modern electric appliances are very efficient

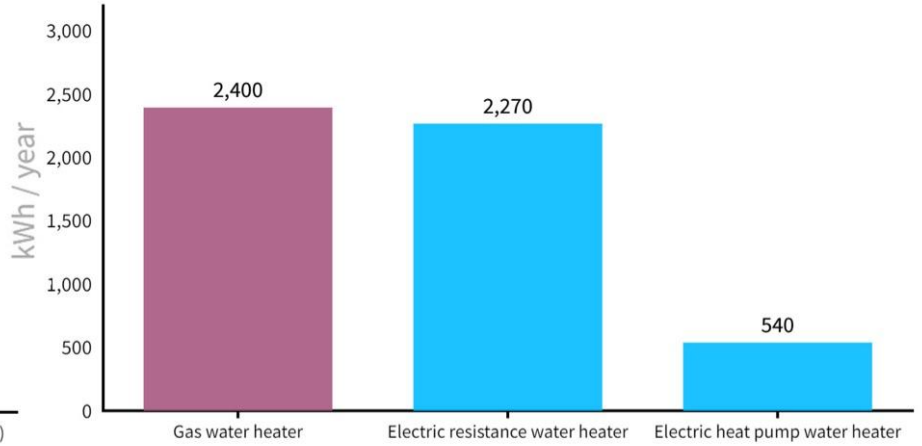
"Another benefit of electric machines is that they are far more efficient than their fossil fuel counterparts. This comes down to simple thermodynamics, **electric machines have less energy waste".** Quote and graphs from [Rewiring Australia home page]

Space heaters | Average yearly energy use in kWh



Based on average Australian water heating energy needs of 2828 kWh per year. Solar capacity factor of 17.14%. Heat pump COP 4.0. Electric resistance COP 0.95. Gas COP 0.9. Wood COP 0.75.

Water heaters | Average yearly energy use in kWh



Based on average Australian water heating energy needs of 2156 kWh per year. Solar capacity factor of 17.14%. Heat pump COP 4.0. Electric resistance COP 0.95. Gas COP 0.9. Wood COP 0.75.

Rewiring Australia

Going electric saves money and emissions

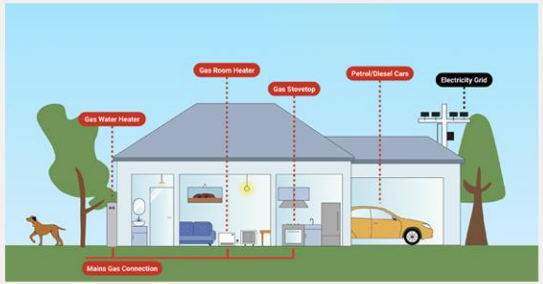
Saul Griffith (p.10):
“If we electrify the “average” Australian household, with solar panels on the roof, a home battery, electric vehicles in the garage, and replacement of gas appliances with efficient electric ones, **we can save thousands per year in household costs for the average home by 2030.**”

Gas and petrol home

Average running costs

$5,300 per year

$53,000 over 10 year lifetime of appliances



- Fossil fuel grid electricity
- Gas space heater
- Gas hot water heater
- Gas cooking
- Petrol and diesel cars

Energy emissions

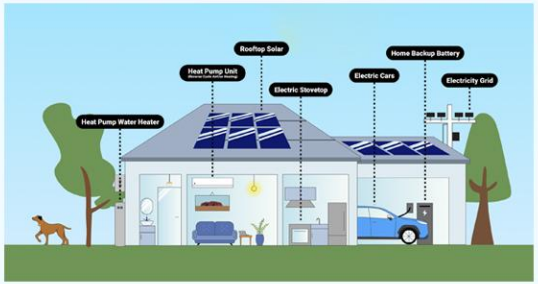
9,550 kg CO2e per year

Electrified home

Average running costs

$1,850 per year

$18,500 over 10 year lifetime of appliances



- Rooftop solar & clean electricity
- Heat pump (reverse cycle AC)
- Heat pump hot water
- Induction cooking
- Electric cars

Energy emissions

ZERO visit www.rewiringaustralia.org

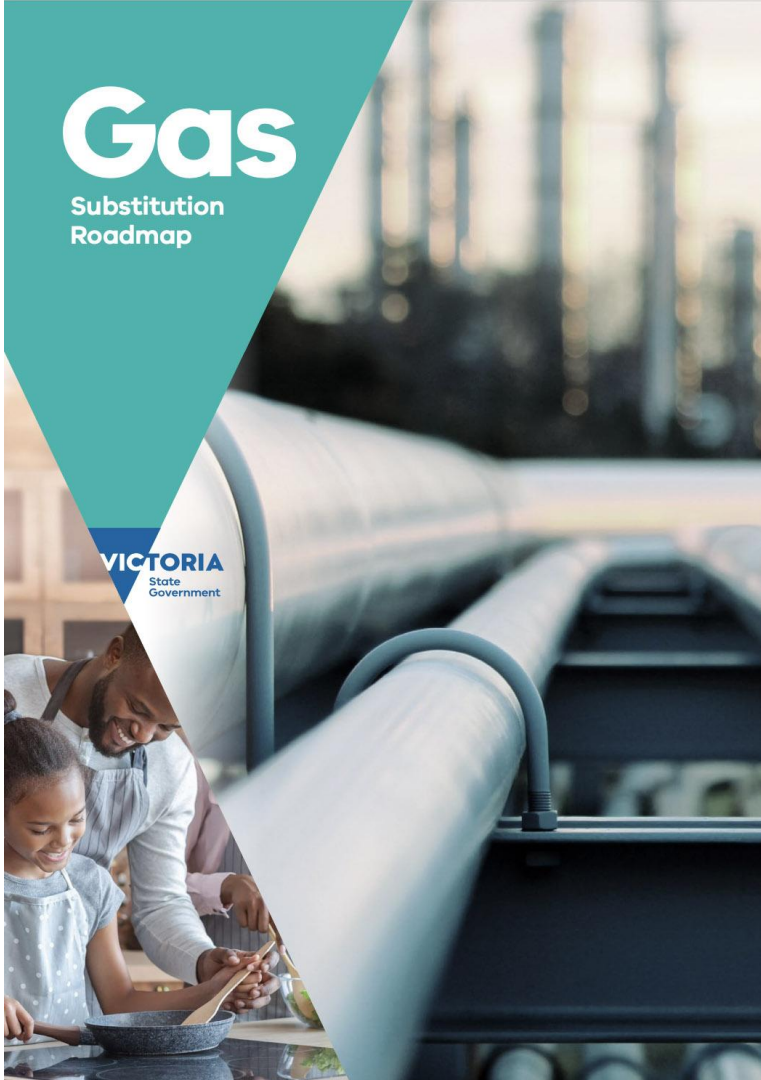
Graphics from Rewiring Australia’s home page.
Data from Saul Griffith’s Castles and Cars Report for Rewiring Australia pp. 10-15, 20, substantiated in accompanying Technical Report pp. 6, 8-19, Victorian data on pp. 30-33, emissions summary pp. 60-62, methodology summary including pricing and emissions discussion pp. 70-106.

B) Electric Households save money

“Completely converting to an all-electric home can save $1,250 per year, in addition to the $950 saving from the existing solar system. Adding a medium-sized battery can also save a further $520 per year.”

[Victorian Gas Substitution Roadmap]

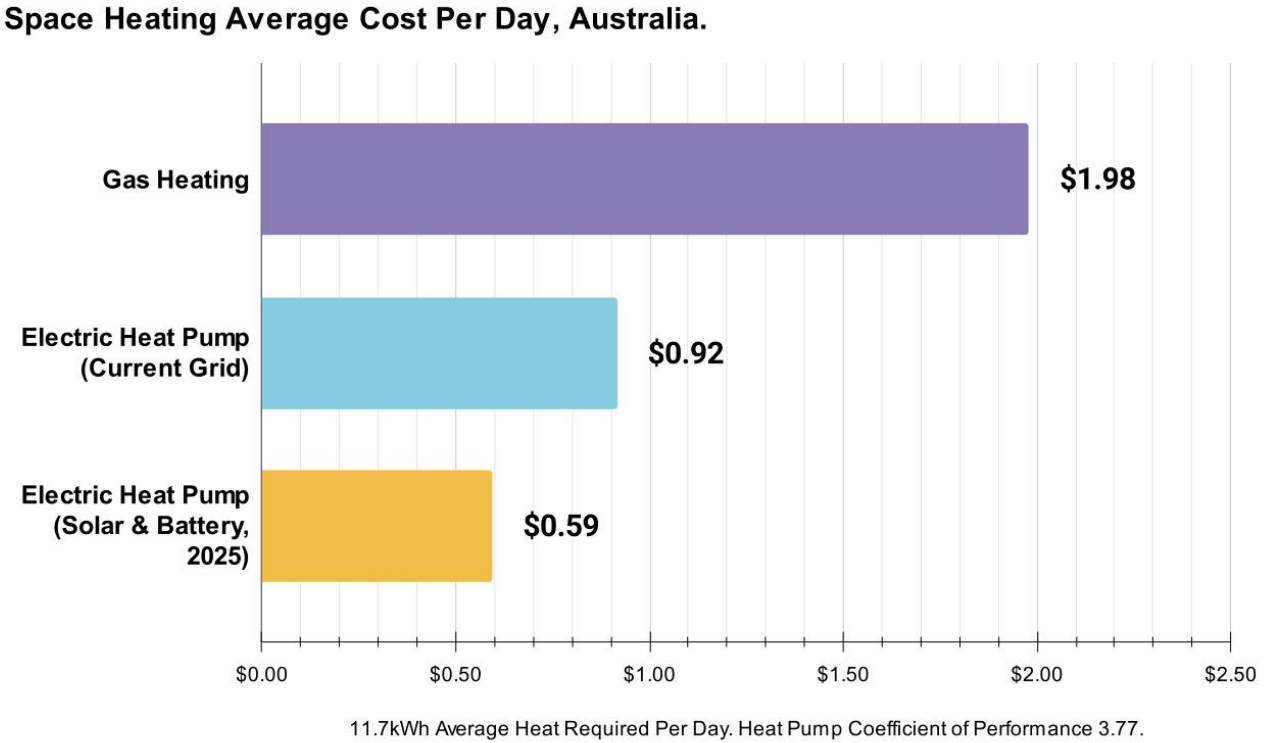
Figures do not include electric vehicles and are from 2021.



Space heating

Space heating uses a lot of energy (58% of appliance load in Victoria)

Reverse cycle air conditioners have an efficiency of 3.8 compared to 0.9 for gas space heating and **cost a third or less to run**

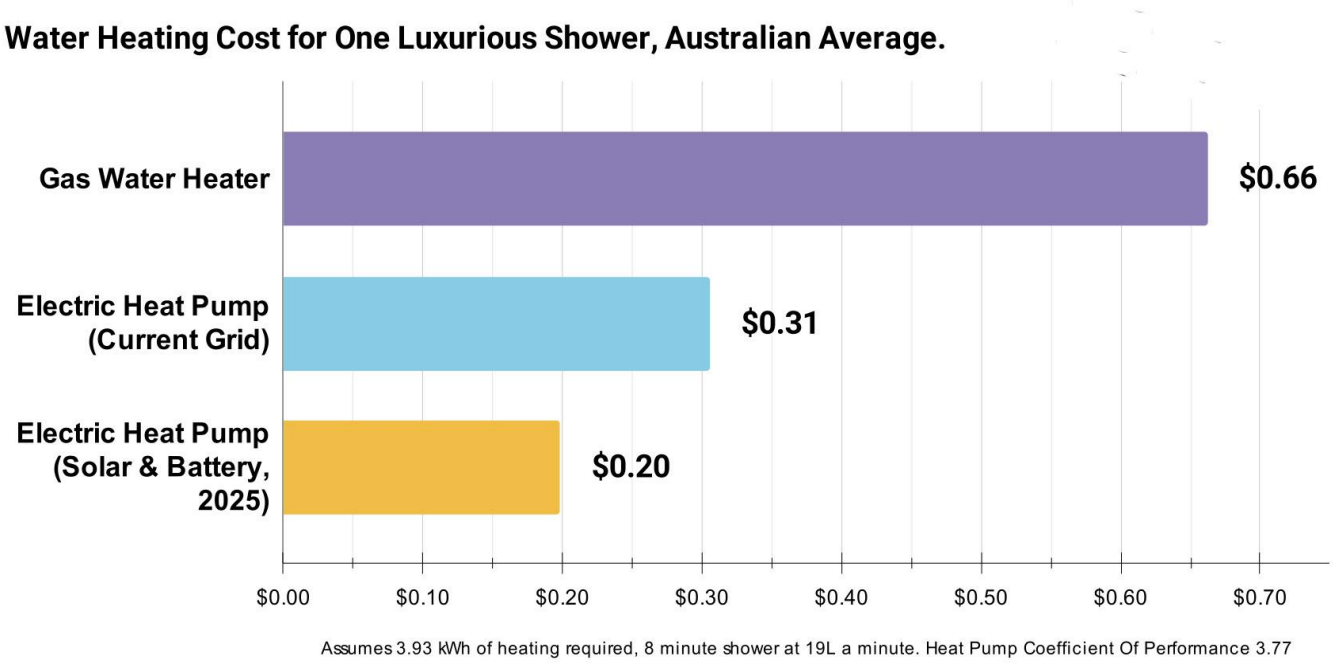


Data and graph from Saul Griffith's Castles and Cars Report for Rewiring Australia p. 13

Hot water

Water heating is the second largest household energy use at 24% of appliance load

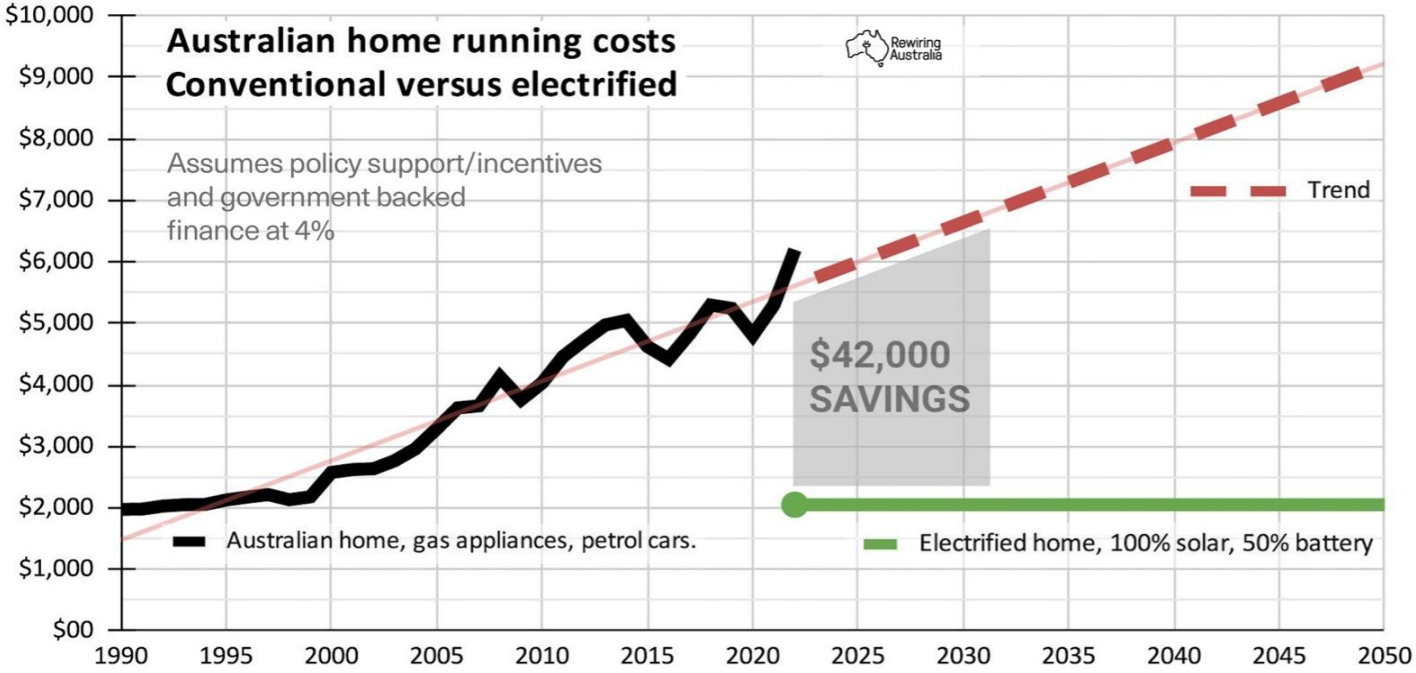
Heat pump hot water offers efficiency gains and **halves the cost compared to gas hot water**



Data and graph from Saul Griffith's Castles and Cars Report for Rewiring Australia p. 14

Electrified homes freeze energy costs

$12bn stimulus delivers full electrification by 2030, $302bn economic boost by 2035



Griffith (p.10) “Our mild climate, and relatively high price of petrol, diesel, and natural gas, mean that **the economics of electrification are attractive in Australia** before they are in America.

With a large commitment to electrification, Australia can reap the economic savings sooner, pass the savings onto real Australian families”

Graph from home page of Rewiring Australia, and in Graph 5, p.10. in the report Electrification is anti inflationary, which draws a parallel between the methodology of Biden’s flagship climate act, the Inflation Reduction Act (IRA), and the methodology used by Griffith and team creating the dataset behind the Castles and Cars Report and accompanying Technical Report.

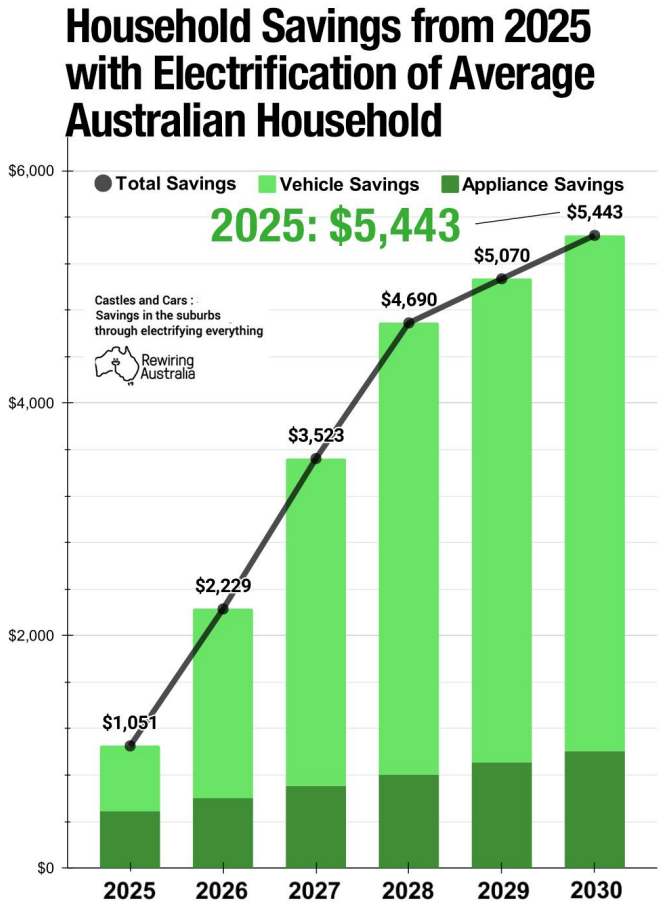
.”

Savings improve over time as costs drop

Each year energy costs for conventional households will keep rising as they have for the last thirty years.

Moving away from gas appliances and petrol cars creates **savings that rise over time** for electrified households.

By 2030, electric households - compared to conventional gas and petrol households - would **save around $5,000 per year**.



Data, graph from Saul Griffith's Castles and Cars Report for Rewiring Australia p. 7, substantiated in accompanying Technical Report pp. 8-12, 14, 18: annual savings at 2030 at $5,443 Fig. 3.9. Vic data on pp. 33, Fig 3.30. Victorian annual electrified household savings were slightly less at 2030 at $5.301.

Invest only $12 billion and reap $300 billion in savings by 2035

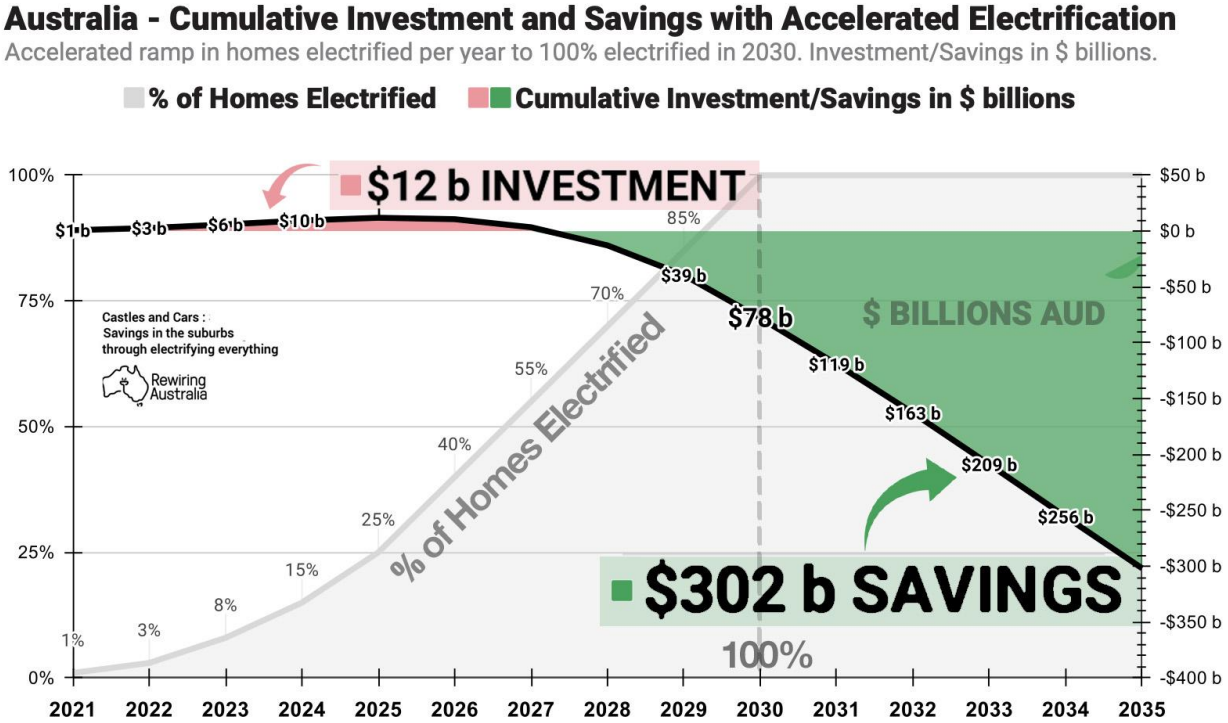
Powerful stimulus for a locally generated increasingly fossil fuel independent economy

With just **$12b** government support, our economy would **benefit by a total of $300 billion by 2035**.

That's money in the pocket of local households that can be spent right here at home.

Keeping finance local
Saul Griffiths analysed energy and finance flow for his own postcode 2151. Instead of an average household annual spend on energy of $5,000 "nearly all of which leaves town", local communities could generate around a half of all energy used with solar.

"We could be keeping the majority of the $20m a year that currently leaves the community and **spending a lot of it here locally** instead."



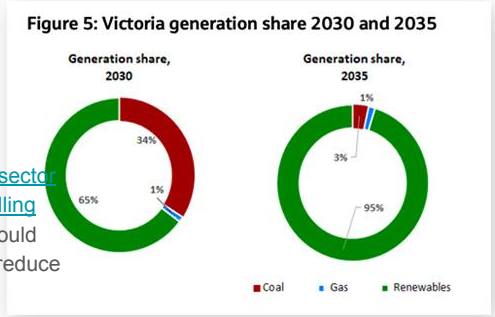
Data, graph from Saul Griffith's Castles and Cars Report for Rewiring Australia p. 17, substantiated in accompanying Technical Report pp. 8-12, 14, 18: annual savings at 2030 at $5,443 Fig. 3.9. Victorian data on p. 33, Fig 3.30. Victorian annual electrified household savings were slightly less at 2030 at $5,301.

But are electric appliances really cleaner?

What about Victoria's dirty grid?

Our grid is decarbonising:
34% renewables in 2021/22,
with a 65% by 2030 target announced, and 95% by 2035.

Jacobs modelling for DELWP in Victorian electricity sector renewable energy transition - energy markets modelling report found that meeting the 95% by 2035 target would require 1.5GW new capacity per annum and would reduce wholesale electricity prices.



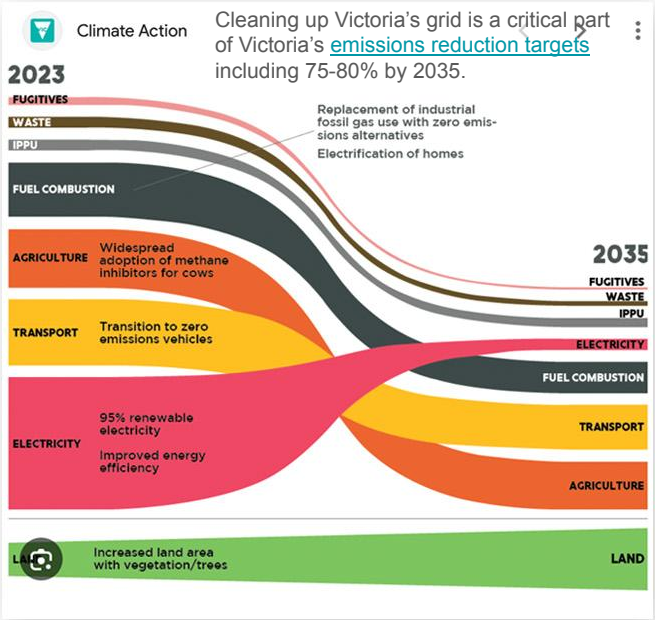
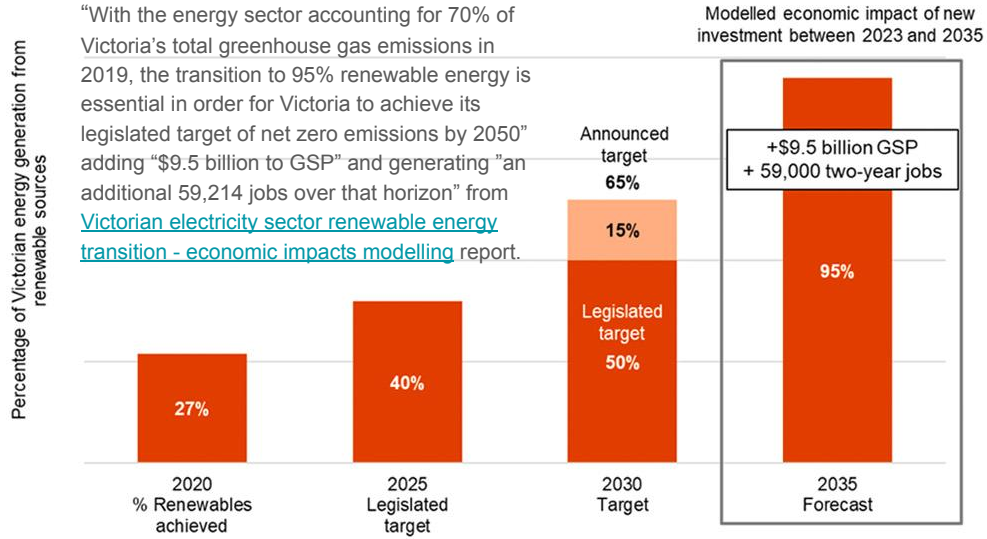


Figure 1 Estimated economic impact of new investment in renewable energy and storage between 2023 to 2035 [2]

"With the energy sector accounting for 70% of Victoria's total greenhouse gas emissions in 2019, the transition to 95% renewable energy is essential in order for Victoria to achieve its legislated target of net zero emissions by 2050" adding "$9.5 billion to GSP" and generating "an additional 59,214 jobs over that horizon" from Victorian electricity sector renewable energy transition - economic impacts modelling report.



How clean are solar panels?

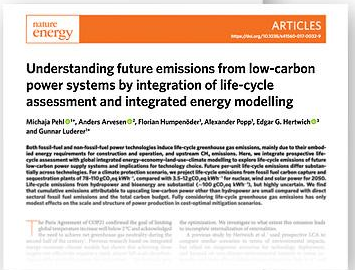
Do they have a hidden ‘carbon debt’?

Fraunhofer Institute publishes a comprehensive PV market annual Photovoltaics Report which states solar panel energy payback times ranging from **1.1years** (Europe) to **0.9 years** (South) (Slide 8) with Australia at 0.74 years (Slide 36). Price learning curve 25% reduction per doubling (Slide 49).

“There was a concern that it is a lot harder than suggested by energy scenario models to achieve climate targets, because of the energy required to produce wind turbines and solar panels and associated emissions,” explains project leader Dr Gunnar Luderer

Luderer tells Carbon Brief: “The most important finding [of our research] was that the expansion of wind and solar power...comes with life-cycle emissions that are much smaller than the remaining emissions from existing fossil power plants,

Is there a hidden carbon debt from manufacture of solar panels? Carbon Brief interviews Dr Gunnar Luderer about a Potsdam Institute for Climate Impacts Research study, which states that full life-cycle emissions accounting has only a “modest effect” on the much lower figures (3.4-12g CO2e/kWh) for technologies such as wind and solar compared to fossil fuels with CCS (78-110gCO2e/kWh).


nature energy ARTICLES

Understanding future emissions from low-carbon power systems by integration of life-cycle assessment and integrated energy modelling

Michaja Pehl, Anders Arvesen, Florian Humpenöder, Alexander Popp, Edgar G. Hertwich and Gunnar Luderer

Doesn’t it take years to pay off your solar?

Solar Victoria states that solar panels can have a payback period as low as three years with solar rebates.

Solar Victoria

3-5 year pay back

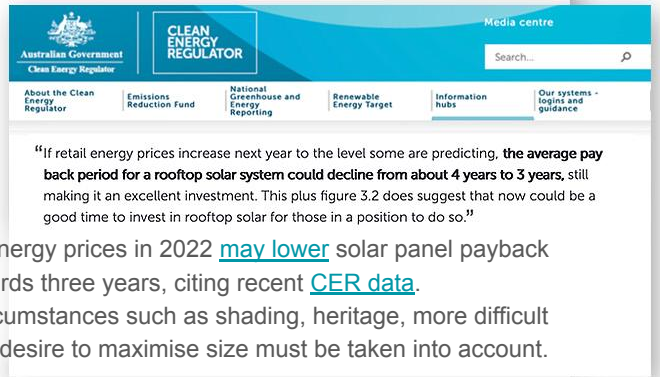
With the Solar PV Rebate a system in Victoria could pay back within three and five years.

Rooftop solar payback set to shrink to three years, thanks to costly coal and gas

November 17, 2022 by Sophie Vorrath

one step off the grid

In its latest quarterly carbon market report, the Clean Energy Regulator says the pay back period for rooftop solar could drop from four years to three, reinforcing its status as an “excellent investment” for Australian households.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“If retail energy prices increase next year to the level some are predicting, **the average pay back period for a rooftop solar system could decline from about 4 years to 3 years,** still making it an excellent investment. This plus figure 3.2 does suggest that now could be a good time to invest in rooftop solar for those in a position to do so.”

The rise in energy prices in 2022 may lower solar panel payback periods towards three years, citing recent CER data. However circumstances such as shading, heritage, more difficult roofs, or the desire to maximise size must be taken into account.

But what about EVs - are they really cleaner?

What happens if you charge on the grid instead of using rooftop solar?

Victoria's grid is decarbonising:
34% renewables in 2021/22, with 65% by 2030 and 96% by 2035 targets.

Drop emissions by half
Australia sits midway between Poland, where an EV charged on Poland's coal-fired grid still saves 40%, and Germany at 61% (T&E 2022 update). In Australia, you **drop vehicle emissions by 50% on average**, charging on the grid, right now (comparisons from Ember).

Of course you can do better with your own rooftop solar!

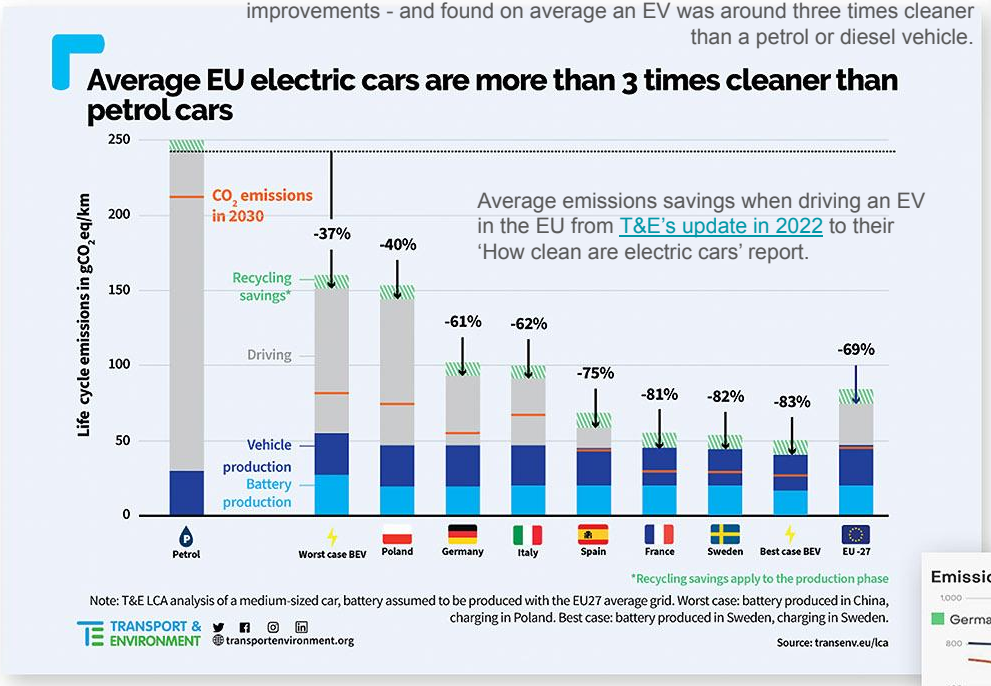
According to an NMRA/PwC report EVs save 97/185gCO2/km and cost 3c/km instead of 14c/km. Owners save $1,700/pa (pp. 4-5).

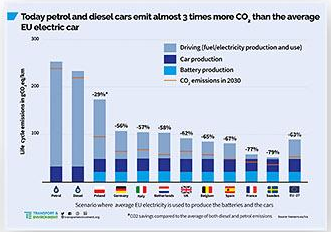
A Greenpeace/Evenergi report on electrifying fleets states that fleet electrification alone would reduce light car emissions by 10% and light commercial by 30% in Australia. Upfront costs would be cheaper by 2025 on a lifecycle basis (pp. 17, 20).

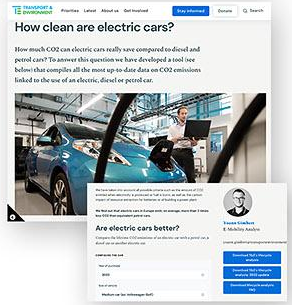
TRANSPORT & ENVIRONMENT

How clean are electric cars?

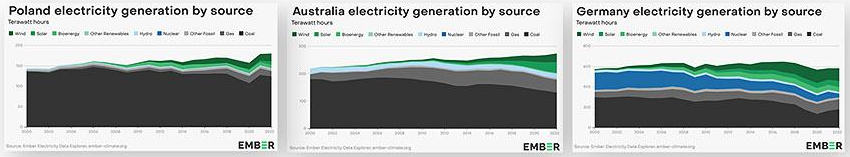
T&E's comprehensive 2020's report on EV LCAs accounted for upcoming improvements - and found on average an EV was around three times cleaner than a petrol or diesel vehicle.

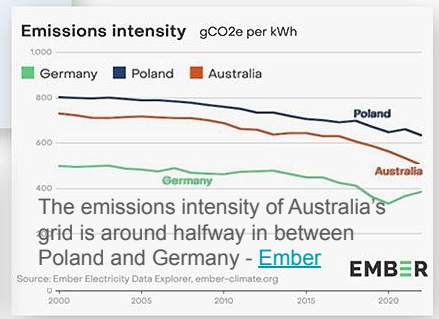






T&E have developed an online tool to calculate how clean various models of EVs, in various EU countries, are.






Going electric is
good for our health

Electric appliances are better for your health

Household gas is a fossil fuel (p. 1)

Using gas in our homes increases indoor pollutants that harm our bodies and the environment. Gas appliances, particularly gas cooktops give off combustion byproducts that impact our health, including nitrous oxide and fine particulates (PM2.5), impacting respiratory and cardiac systems; formaldehyde and volatile organic compounds like benzene - known carcinogens (gas cooktops linked to blood cell cancers); and carbon monoxide which can be fatal.

All gas appliances must be serviced every two years by a licensed gas fitter with a CO meter.

"Formaldehyde is listed as a human carcinogen." "we used a real-time formaldehyde monitor to show that simmering of a gas burner can increase indoor formaldehyde concentrations above...(OEHHA) Acute Reference Exposure Level"

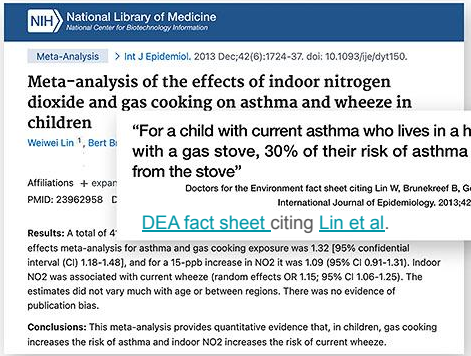
Poppendieck D & Gong M, cited in Health Effects in Gas Stove Pollution, Seals B & Krasner A, Rocky Mountain Institute, 2020

Rocky Mountain Institute (RMI) review (download here) Ref 32

"A child living with gas cooking in the home faces a comparable risk of asthma to a child living with household cigarette smoke."

Dr Kate Charlesworth, Climate Council, quoted in Asthma Australia media release 'Invisible Danger, Gas, Asthma and our Children'

Asthma Australia article on Climate Council report



NIH National Library of Medicine
National Center for Biotechnology Information

Meta-Analysis > Int J Epidemiol. 2013 Dec;42(6):1724-37. doi: 10.1093/ije/dyt150.

Meta-analysis of the effects of indoor nitrogen dioxide and gas cooking on asthma and wheeze in children

Weiwei Lin [1], Bert B...

Affiliations + expan...

PMID: 23962958 D...

Results: A total of 4...
effects meta-analysis for asthma and gas cooking exposure was 1.32 [95% confidential interval (CI) 1.18-1.48], and for a 15-ppb increase in NO2 it was 1.09 (95% CI 0.91-1.31). Indoor NO2 was associated with current wheeze (random effects OR 1.15; 95% CI 1.06-1.25). The estimates did not vary much with age or between regions. There was no evidence of publication bias.

Conclusions: This meta-analysis provides quantitative evidence that, in children, gas cooking increases the risk of asthma and indoor NO2 increases the risk of current wheeze.

"For a child with current asthma who lives in a home, with a gas stove, 30% of their risk of asthma is from the stove"

Doctors for the Environment fact sheet citing Lin W, Brunekreef B, Gehring U, International Journal of Epidemiology. 2013;42:1724-37

DEA fact sheet citing Lin et al.

"increased allergic inflammation of the nose in adults and children" are associated with "homes with gas cooking appliances"

Doctors for the Environment fact sheet citing Piekarska B et al, Allergy and Asthma Proceedings 2018; 39, 6:e71-e77(7)

Doctors for the Environment (DEA) fact sheet Ref 23

Air pollution exposure may cause heart attack within an hour

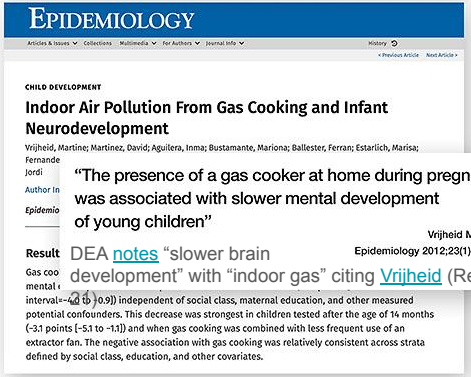
By Laura Williamson, American Heart Association News

Published: April 22, 2022

"The adverse cardiovascular effects of air pollution have been well documented. But we were still surprised at the very prompt effects," said Haidong Kan, a professor in the School of Public Health at Fudan University in Shanghai.

"Another surprise was the non-threshold effects of air pollution," he said. "In other words, any concentrations of air pollutants (such as fine particulate matter, nitrogen dioxide, sulfur dioxide and carbon monoxide) recorded in the present study may have the potential to trigger the onset of a heart attack."

This AHA article notes "Short-term exposure to any level of fine particulate matter, nitrogen dioxide, sulfur dioxide and carbon monoxide was associated with the onset of all types of acute coronary syndrome." Gas cooking increases indoor concentrations of fine particulate matter, nitrous oxide and carbon monoxide.



EPIDEMIOLOGY

CHILD DEVELOPMENT

Indoor Air Pollution From Gas Cooking and Infant Neurodevelopment

Vrijheid, Martine; Martinez, David; Aguilera, Inma; Bustamante, Mariona; Ballester, Ferran; Estarlich, Marisa; Fernande... Jordi

Author In...

Epidemio...

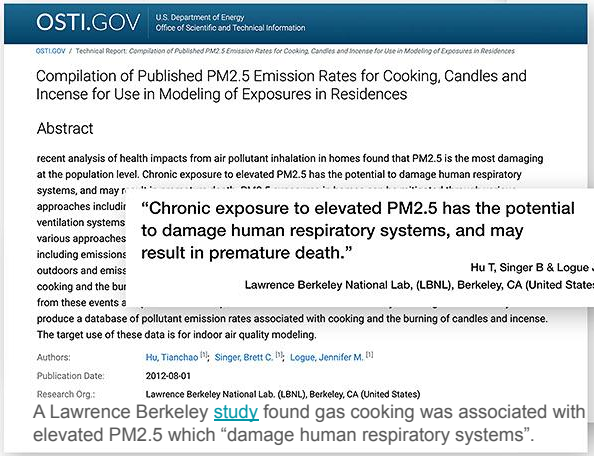
Result...

Gas coo... mental ... interval=-4.0 to 0.9)] independent of social class, maternal education, and other measured potential confounders. This decrease was strongest in children tested after the age of 14 months (-3.1 points [-5.1 to -1.1]) and when gas cooking was combined with less frequent use of an extractor fan. The negative association with gas cooking was relatively consistent across strata defined by social class, education, and other covariates.

"The presence of a gas cooker at home during pregnancy was associated with slower mental development of young children"

Vrijheid M et al, Epidemiology 2012;23(1):23-32

DEA notes "slower brain development" with "indoor gas" citing Vrijheid (Ref 24)



OSTI.GOV U.S. Department of Energy, Office of Scientific and Technical Information

OSTI.GOV / Technical Report: Compilation of Published PM2.5 Emission Rates for Cooking, Candles and Incense for Use in Modeling of Exposures in Residences

Compilation of Published PM2.5 Emission Rates for Cooking, Candles and Incense for Use in Modeling of Exposures in Residences

Abstract

recent analysis of health impacts from air pollutant inhalation in homes found that PM2.5 is the most damaging at the population level. Chronic exposure to elevated PM2.5 has the potential to damage human respiratory systems, and may r... approaches includi... ventilation systems... various approaches... including emissions... outdoors and emiss... cooking and the bur... from these events a... produce a database of pollutant emission rates associated with cooking and the burning of candles and incense. The target use of these data is for indoor air quality modeling.

Authors: Hu, Tianchao [1]; Singer, Brett C. [1]; Logue, Jennifer M. [1]

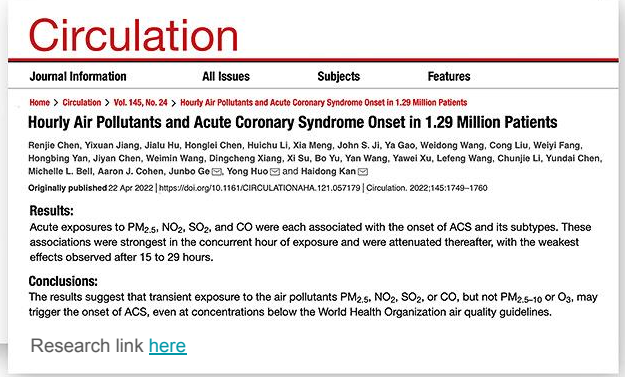
Publication Date: 2012-08-01

Research Org.: Lawrence Berkeley National Lab. (LBNL), Berkeley, CA (United States)

"Chronic exposure to elevated PM2.5 has the potential to damage human respiratory systems, and may result in premature death."

Hu T, Singer B & Logue J, Lawrence Berkeley National Lab, (LBNL), Berkeley, CA (United States)

A Lawrence Berkeley study found gas cooking was associated with elevated PM2.5 which "damage human respiratory systems".



Circulation

Journal Information | All Issues | Subjects | Features

Home > Circulation > Vol. 145, No. 24 > Hourly Air Pollutants and Acute Coronary Syndrome Onset in 1.29 Million Patients

Hourly Air Pollutants and Acute Coronary Syndrome Onset in 1.29 Million Patients

Renjie Chen, Yixuan Jiang, Jialu Hu, Honglei Chen, Huichu Li, Xia Meng, John S. Ji, Ya Gao, Weidong Wang, Cong Liu, Weiyi Fang, Hongbing Yan, Jiyan Chen, Weimin Wang, Dingcheng Xiang, Xi Su, Bo Yu, Yan Wang, Yawei Xu, Lefeng Wang, Chunjie Li, Yundai Chen, Michelle L. Bell, Aaron J. Cohen, Junbo Ge, Yong Huo and Haidong Kan

Originally published 22 Apr 2022 | https://doi.org/10.1161/CIRCULATIONAHA.121.057179 | Circulation. 2022;145:1749–1760

Results:
Acute exposures to $PM_{2.5}$, NO_2, SO_2, and CO were each associated with the onset of ACS and its subtypes. These associations were strongest in the concurrent hour of exposure and were attenuated thereafter, with the weakest effects observed after 15 to 29 hours.

Conclusions:
The results suggest that transient exposure to the air pollutants $PM_{2.5}$, NO_2, SO_2, or CO, but not $PM_{2.5-10}$ or O_3, may trigger the onset of ACS, even at concentrations below the World Health Organization air quality guidelines.

Research link here

Gas cooking affects health

Shift to induction cooking to protect your family from the risk of health impacts. You can get started with a **low cost portable unit**.

Asthma Australia has alerted the public to the health impacts of gas cooking, advocating for induction cooking, including publicising UQ's 2018 research. Recently Asthma Australia stated that gas cooking produces "a variety of air pollutants including fine particulate matter (**PM2.5**), **nitrogen dioxide**, **carbon monoxide** and **formaldehyde**".

ASTHMA AUSTRALIA

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Gas stoves and damp houses increase Aussie asthma rates

"We found that 12 per cent of childhood asthma is attributable to exposure to gas stoves used for cooking, and eight per cent is linked to household dampness," Dr Knibbs said.

"Cooking with gas releases chemicals such as nitrogen dioxide and formaldehyde, which causes inflammation in the airways and exacerbates asthma.

UQ research established that **gas cooking caused 12.3% of childhood asthma**

Open Access Article

International Journal of Environmental Research and Public Health

Population Attributable Fraction of Gas Stoves and Childhood Asthma in the United States

by Talor Gruenwald [1,†], Brady A. Seals [1,*], Luke D. Knibbs [2,3] and H. Dean Hosgood III [4]

Int. J. Environ. Res. Public Health **2023**, *20*(1), 75; https://doi.org/10.3390/ijerph20010075

Received: 4 November 2022 / Revised: 12 December 2022 / Accepted: 14 December 2022 / Published: 21 December 2022

(This article belongs to the Special Issue Second Edition of the Air Pollution Impact on Children's Health)

A recent US meta study found that **"12.7% of current childhood asthma in the US is attributable to gas stove use."**

As well as **nitrous oxide** which is a potent respiratory irritant, household gas when burnt releases **fine particulates**, implicated in heart health impacts, and **formaldehyde** (RMI, refs 31,32, 72, 76, 116), **benzene and other volatile organic compounds** that are **known carcinogens**: "Even low doses of airborne benzene raise the risk of a variety of cancers, including **lymphomas and leukemia**"

Have a gas stove? How to reduce pollution that may harm health

Gas stoves affect air quality inside and outside your home, circulating pollutants that raise risk for asthma and other illnesses.

September 7, 2022
By Wynne Armand, MD, Contributor

Harvard Health Publishing
HARVARD MEDICAL SCHOOL

Leaks, asthma and toxic chemicals - check out this Harvard Health Publishing article.

Gas stoves are linked to childhood asthma

Cooking with gas stoves creates nitrogen dioxide and releases additional tiny airborne particles known as PM2.5

Children living in households that use gas stoves for cooking are 42% more likely to have asthma,

Gas stoves leak even when they are off

The Stanford study tested gas stoves in 53 homes. All of the stoves leaked methane gas, even when turned off. These leaks equaled 76% of their total methane gas emissions.

Toxic chemicals in gas stoves and pipelines

What's more, a study from the Harvard T.H. Chan School of Public Health and PSE Healthy Energy showed that gas appliances also introduce other toxic chemicals into homes. In their analysis, they identified 21 different hazardous air pollutants known as volatile organic compounds (VOCs). compounds (VOCs). For example, benzene, hexane, and toluene were present in almost all of the gas samples tested. Exposure to some VOCs raises risks for asthma, cancer, and other illnesses.

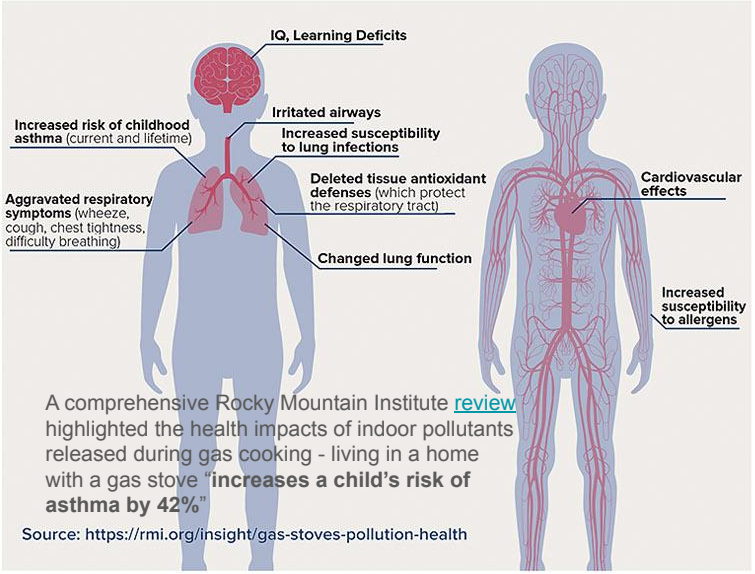
Gas Stoves: Health and Air Quality Impacts and Solutions

By Brady Seals, Andee Krasner

RMI

Health Effects from Gas Stove Pollution

Gas stoves can produce elevated levels of Nitrogen Dioxide (NO_2), a toxic gas. Health Effects of NO_2 in Children May Include:



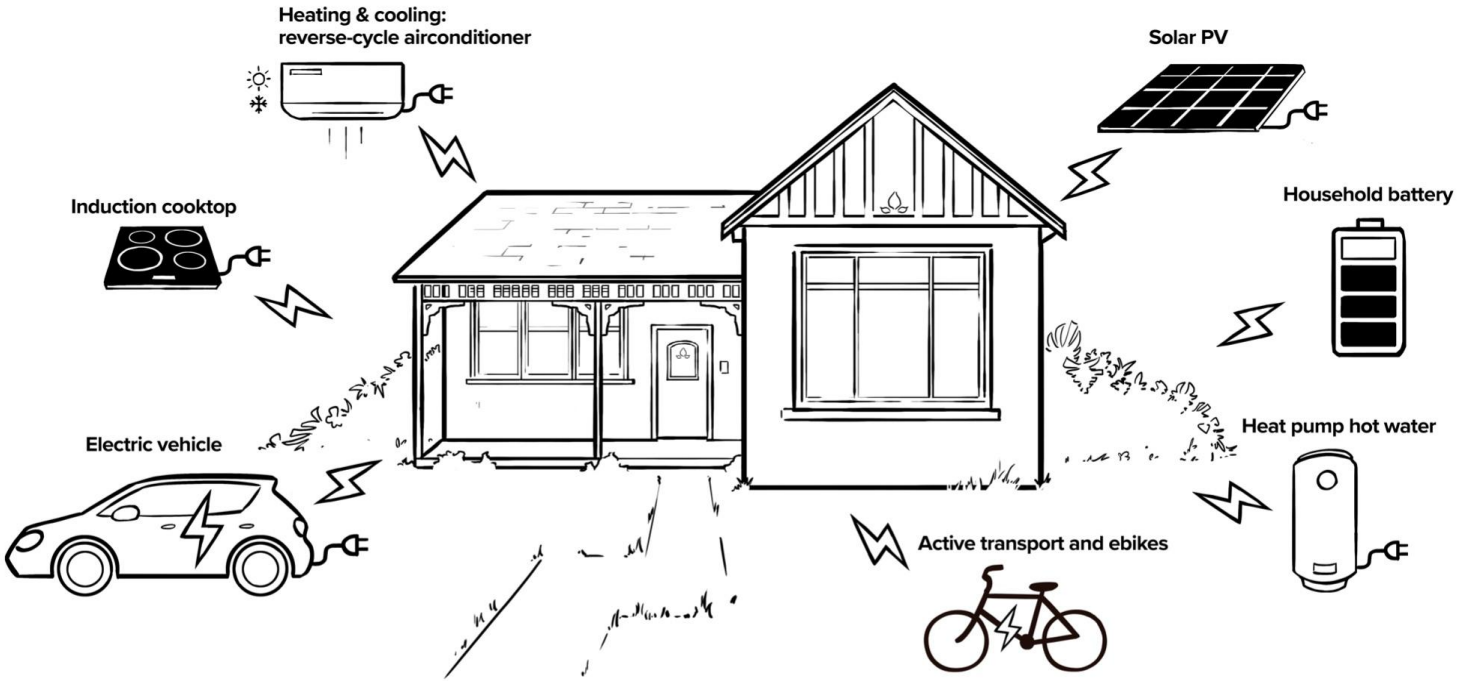
A comprehensive Rocky Mountain Institute review highlighted the health impacts of indoor pollutants released during gas cooking - living in a home with a gas stove "**increases a child's risk of asthma by 42%**"

Source: https://rmi.org/insight/gas-stoves-pollution-health

Rangehoods reduce **but do not eliminate** gas stove health impacts - more details and studies on page 23 of this Climate Council report,

How do we go electric?

Here are some solutions



In summary - households currently contribute 42% of domestic emissions.
This energy usage can be slashed by over 60% through transitioning to a fully electric home.

So how do we do this?

1) We replace gas appliances with more efficient electric ones - reverse cycle air conditioner for heating and cooling, heat pump hot water, induction cooking, adding solar and electrifying our transport.
2) We improve our homes thermal performance, starting with draft proofing, floor to ceiling drapes, and improving insulation.

Induction cooking

Induction cooking is more efficient and convenient

- **Highly efficient** - Check out the Climate Council's report on gas vs electric appliances 'Switch and Save' pp. 7-8.
- **Very fast** (boils water in around 2 min compared to 4 min for gas - Choice).
- **Responsive, precise** control - Fast Company article includes chefs moving to induction.
- Much **easier to clean.** Check out this Choice explainer on induction cooktops - how they work, features and purchasing guidelines.
- **Lower burn risk** - check out this mini guide from Renew on induction cooktops including sections on safety (most have features to prevent overheating) and installation.
- **Costs less** to run - real savings occur when a household switches off the last gas appliance, which is often a gas cooktop. Typical yearly gas connection fees are around $300 per year (Renew cost comparison report, pp. 2-3). It is possible to disconnect gas, eg. with a two burner portable while waiting for purchase and installation of induction cooktop.
- Get started with a **low cost** portable unit.

Heat pumps for heating and cooling

Heat pumps - reverse cycle air conditioners

- Reverse cycle air conditioners (RCAC) are very efficient. “Heating a space with a reverse-cycle air conditioner is about four times more efficient than using natural gas” **-** Conversation article. RCACs us same technology as your fridge - this explainer from Choice is a good place to start.
- Your **RCAC can be used for heating** in winter as well as cooling in summer. Check out this comprehensive buyers guide from Renew on using electricity to heat your home in winter - RCACs top the list.
- RCACs **cost half as much to run** as gas space heating or less.
- **Installation costs vary** depending on size, type of refrigerant, number of units and whether they are single or multi headed.
- It is worth paying attention to **fixing draughts** and other energy efficiency basics - check out this report from the Climate Council how electrification and energy efficiency can lower costs, improve comfort and improve your health.
- Your RCACs **need their filters cleaned** regularly.

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Hot water

Heat Pump Hot Water

- Heat pump hot water is **very efficient -** 3,300kWh for a family our four for a year (equiv to 11,900MJ) compared to 30,000MJ of gas - Grattan Institute, p. 9.
- Costs around **half as much to run** (or less), with greater savings when paired with solar
- With solar PV, your heat pump hot water service can **store daytime solar energy** like a battery
- **Costs vary** depending on factors like size, the quality of refrigerant and installation
- **Do research now**, before appliance failure
- **Substantial rebates** available from Solar Victoria and Victorian Energy Upgrades program
- The sooner you replace, the sooner you make **cost and greenhouse gas savings**

Electric Vehicles

Transport - why go electric?

- **Better for health** - less air pollution, including improving air inside your vehicle. This news feature from PNAS details clear health benefits from electrifying transport: “EVs slash the ambient levels of air pollutants that have been linked to hundreds of thousands of early deaths annually around the world”.
- **Cheaper to run** ($4 instead of $14/100km (Slide 2)), especially if charging with rooftop solar, and may well cost less overall by 5-10 years depending on model, amount driven - for more number crunching check out this article by *Which Car*.
- **Highly efficient** - over three times more efficient than an internal combustion engine. This accessible article in *The Driven* about a Sydney - Tassie road trip illustrates the difference, including “Electric vehicles are very efficient, 95% of the energy is used to move you forward, and only about 5% is lost to heat and friction. Petrol cars, on the other hand, use only 20% of the available energy to drive the wheels, and 80% is wasted as heat and friction in the engine and gearbox.”
- Significantly **reduces** **greenhouse gas emissions**, even if just running off grid electricity.
- You can further reduce your emissions and improve your health with **e-bikes and active transport**.

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Electric vehicles - the transition is on

More models, longer range

In 2023 we now have **59 different BEV models,** a 59% increase since 2022, with around 130,000 EVs on Australian roads (109,000 BEVs vs 21,000 PHEVs - hybrid share is dropping). (EVC pp. 7,10)

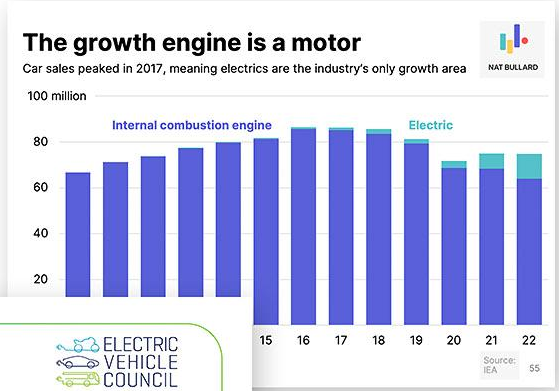
Many models now have **ranges over 500 km** and most over 300 km.

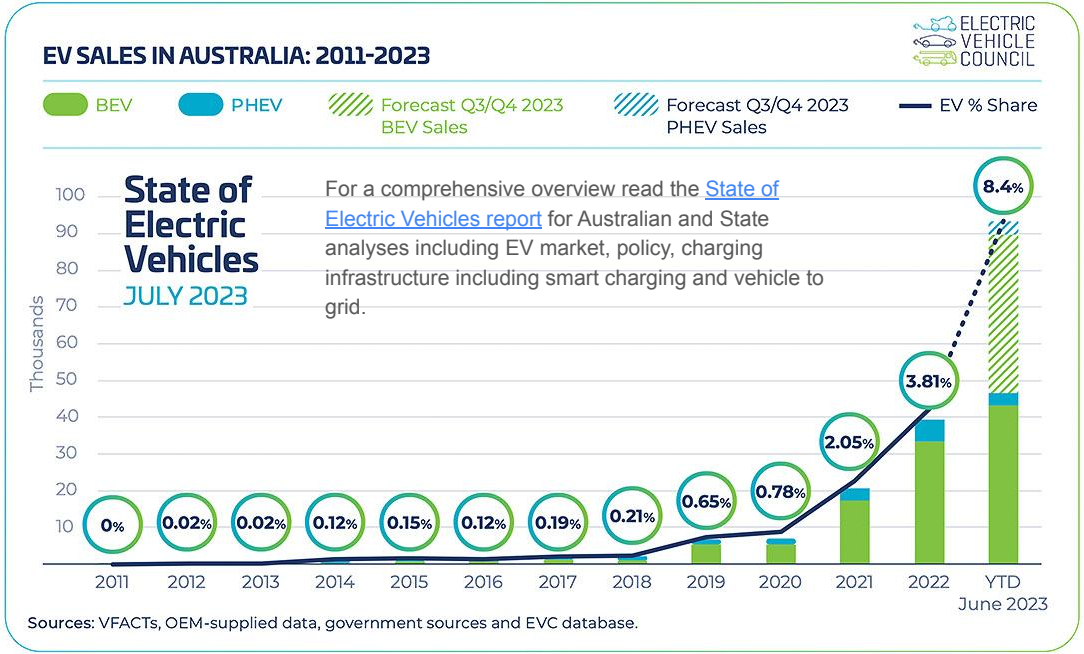
Fuel efficiency standards

Past lack of fuel efficiency standards has resulted in **limited model choice** in Australia: "Australia and Russia are among the only developed nations without fuel efficiency standards. This means there is no requirement for global vehicle manufacturers to send their best fuel saving technology to Australia… This is why in the EU there are around 230 models of EV available, compared to only 60 in Australia" - 2023 Australian Government Fuel Efficiency Standards report.

EV market share will more than double in 2023: 8.4% of new car sales in first half of 2023 compared to 3.8% in 2022, with some models selling out within hours of release.

Peak Car in 2017 with EVs the only growth sector - Nat Bullard/Bloomberg, slide 55





Charging infrastructure is improving with a 57% increase in high power charging locations to 30 June 2023 (EVC p.17)

Solar PV

Solar basics

- Payback can be **as low as three years with a solar rebate.** Solar Victoria calculates adding rooftop solar reduces energy bills by over $1000 per year, with up to an additional $400 per year from heat pump hot water. If eligible, both rebates can be claimed at once, saving thousands off installation costs.

- Benefits include:
  • **Energy self reliance** - rooftop solar reduces your dependence on fossil fuels. Recent research found that filling only 50% of the world's roofs with solar PV could meet global needs for clean energy.
  • Lock in **25 years of low prices.** Read this Choice guide for more on choosing a reliable, accredited installer and quality panels.

- For a 5kW inverter, people are typically installing 6.6kW of solar panels, or consider three phase for up to 15kW and faster EV home charging.

- **Boroondara Solar Savers** program.

- Victorian government **rebates** now available. Keep an eye out for federal **low interest loans,** indicated in the 2023 budget.

Maximising your solar

- Design your system around your peak usage and **use timers on your appliances** to take advantage of maximum solar generation especially your hot water and EV charging. Make sure that your retail electricity tariff pairs well with your solar and usage patterns.
- A **home battery** can maximise solar savings**,** increasing self consumption and energy independence and resilience.
- **Be EV ready** with a big system to lower your transport costs. If you charge during daylight hours, your EV will be cost your feed in tariff (eg 8c/kWh or typically $0.48/day), compared to offpeak grid at 16c/kWh or standard grid at around 30c/kWh. Check out this article on types of solar EV charging including smart chargers.

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Energy Efficiency

Image: Renew Magazine

Energy Efficiency

- The average efficiency rating of all Victorian homes is a truly terrible 1.8 NatHERS stars (Sustainability Victoria report p. 15).
- Poor energy efficiency and thermal performance results in homes that are too cold in winter and too hot in summer, and coupled with poor ventilation, homes that are at high risk of damp and mould - a risk to the health of occupants.
  A recent comprehensive report led by RMIT looked at existing building stock, improving the design process as well detailing thermal and health impacts of poorly designed buildings - read more here.
- Remediation is possible via gap sealing, insulation, external shading, and strategies that improve window performance.
- Consider a home Energy Audit to work out where to start.
  Sustainability Victoria's Healthy Homes trial found that even modest upgrades (average $2809) "had wide ranging benefits over the winter period" including health and quality of life benefits (p. 5).
- Borrow from the library an energy meter and thermal imaging camera to check for leaks.

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Information to help you go electric

More short video stories here

Some options to get started

- Using your **aircon** **for heating** (and clean the filter!).
- Basic **draught proofing**, plus improve **window performance** with heavy drapes or honeycomb blinds, or try invisible pelmets.
- Get started with a **portable induction cooktop** - Aldi regularly has them for under $100.
- Install a low flow **shower head** and **install timers.** You can group your appliances, such as kitchen appliances or entertainment devices on a smart timing strip, and consider motion sensors or photo sensors to automate residential savings. A single computer & monitor left on can cost $200/year.
- Dump the garage fridge - inefficient old fridges can soak up a lot of energy and increase your power bills.
- **Replace gas appliances** with electric as you can afford - check out Renew's Getting Off Gas Toolkit.
- **Rooftop solar** is a no-brainer, good for energy bills and the environment.

Don’t miss out on Government Rebates

- Most often your **installer will claim** any eligible rebates for you.
- Rebates **change regularly -** check out this Australian government page to search for all available Federal and State rebates.
- Rebates are currently available from the Victorian Government via the **Victorian Energy Upgrades** program and **Solar Victoria.**
- The 2023 Federal Budget announced a $1 billion **Households Energy Upgrades Fund** which will provide low interest loans for energy upgrades.

Key websites:

- energy.vic.gov.au/for-households/victorian-energy-upgrades-for-households
- solar.vic.gov.au/apply
- energy.gov.au/rebates/home-and-business-energy-incentives-vic

In summary-
modern electric appliances:

- Are far more efficient than gas appliances or petrol vehicles
- Better efficiency equals lower running costs
- Even cheaper with your own solar
- Produce less emissions as they
  - use less energy overall
  - use rapidly decarbonising electricity or your rooftop solar
- Contribute to a safer climate and improve family health

Getting involved with Electrify Boroondara

- **By the community** - for the community
- Visit **electrifyboroondara.org** and subscribe
- Keep an eye out **for events**
- Volunteering opportunities
- Your organisation **can support** Electrify Boroondara

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What can you do now?

- This is a journey - **start where you are**
- Try some easy steps first, especially **thermal efficiency basics**
- Try out induction cooking with a **portable induction cooktop** to reduce your family's exposure to gas
- Research electric appliances so you are **ready to switch**
- **Consider solar** - it's like putting your money in the bank to earn interest in the form of reduced energy bills
- Visit https://electrifyboroondara.org/**get-started** for more ideas

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Thank you for having us