Minimum energy standards for Victorian renters: an analysis

November 2024

renew.

Author: Rob McLeod.

This project was funded by Energy Consumers Australia Limited (www.energyconsumersaustralia.com.au) as part of its grants process for consumer advocacy projects and research projects for the benefit of consumers of electricity and gas. The views expressed in this document do not necessarily reflect the views of Energy Consumers Australia.

Renew
552 Victoria St, North Melbourne VIC 3051
Wurundjeri Country

www.renew.org.au

Renew is a national, not-for-profit organisation that inspires, enables and advocates for people to live sustainably in their homes and communities. Established in 1980, Renew advocates in government and industry arenas for policies that promote renewable energy and cut emissions, make our homes healthier, more affordable and climate resilient, and protect consumer rights in our rapidly changing energy markets.

Renew has helped thousands of households save money and reduce their environmental footprint with information on energy efficiency, solar power, rainwater tanks, materials reuse and waste. Our community of climate change action includes readers of our two market-leading sustainability magazines *Renew* and *Sanctuary*, attendants at our Sustainable House Day and other events, users of our online information and calculators, people contacting our advice service, and our research and advocacy partners.

Renew acknowledges the First Nations people as the Traditional Custodians of the lands on which we live and work, and recognise their deep and continuing connection to the land, sea and culture, and their rich contribution to society. We pay our respects to Elders, past and present, and acknowledge that Sovereignty of these lands was never ceded.

Contents

Summary

In June 2024 the Victorian government announced a proposal to expand minimum standards for rental properties. The proposal includes a range of requirements on energy and thermal efficiency that must be met by rental homes, including:

- Insulation in rental properties at an R5 standard (with exemptions)
- Simple draught sealing
- Air conditioning
- Replacement of fixed heaters at the end of life with efficient electric heaters
- Replacement of hot water systems at end of life with efficient electric models

Taken together, these measures appear likely to significantly improve energy efficiency and thermal comfort for many Victorian rental homes, while also phasing out new gas appliances for renters as part of the broader energy transition.

In responding to government consultation on the proposal, Renew has conducted an analysis of what the measures might mean for a typical rental household in Victoria. This report provides a summary of our key findings.

Our analysis considered:

- Thermal efficiency
- Energy usage and bills
- Cost-benefit analysis at the household level
- Greenhouse gas emissions
- Indoor temperatures

Key Findings

Insulation and sealing up draughts are the first step to a more comfortable home.

Ceiling insulation makes a critical difference to home comfort, temperatures, and provides the most important energy savings. R5 insulation cuts hundreds of dollars a year off energy bills and minimises unhealthy indoor temperatures and is an important complementary feature for homes using reverse cycle air conditioning for cooling. Ceiling insulation and draft sealing resulted in even cheaper cooling costs.

All-electric homes are cheaper for tenants to run

Using gas heating was found to result in significantly higher overall heating and cooling costs, even where cooling was added to a household. Replacing gas heaters with split cycle air conditioners lowers renters' energy bills - both for heating in winter, and cooling in summer. Rental households replacing a gas wall furnace heater with a reverse cycle air conditioner at even a relatively low efficiency rating experienced lower bills for heating, and gained the additional benefit of an appliance that could also be used for cooling.

To lower costs for tenants and facilitate the energy transition away from gas, incentives and regulation would drive landlords away from gas connections in rental properties.

While replacing gas heating and hot water has a clear energy and cost benefit, cooking typically uses significantly less energy than other major fixed appliances. However, homes using gas stoves or ovens that remain connected to the gas network are liable for daily connection fees currently costing over $300 per year. As renters do not have agency over the choice of replacement appliances, without regulations requiring that old and/or dysfunctional gas appliances were replaced with energy efficient, electric appliances. many renters will be left paying connection costs into the future. Requiring landlords to take financial responsibility for gas connections fees, while usage costs would continue to be paid by tenants, would act as an incentive to move away from gas appliance in rental properties.

Thermal efficiency

To consider the impact of minimum energy standards including insulation and draught sealing on rental homes, Renew modelled a 3BR detached brick veneer house, based on floor plans representative of many older homes in Melbourne. The baseline scenario had no insulation, basic windows and doors with no specific sealing. The home was approximately 130m2 with 90m2 of conditioned space.

We used FirstRate5 energy modelling software to assess thermal efficiency, including NatHERS ratings, heating loads, cooling loads, and total energy loads.

Because this software is primarily designed for new homes, additional considerations needed to be made to incorporate the effects of draughts, gaps and cracks found in older homes that are proposed to be subject to draught sealing requirements. For this reason, our analysis incorporates the additional losses from gaps and cracks assumed in the consultation RIS.

Heating loads, cooling loads, and total energy loads are provided in MJ/M2 per year, in line with standard NatHERS practice.

Results

Without draught sealing

	HEATING	COOLING	TOTAL	NATHERS RATING
Zero insulation	310.1	67	377.1	**1.3**
R1	186.6	31.1	217.7	**2.8**
R2	169.9	27	196.9	**3**
R5	157.3	23.5	180.8	**3.3**

With draught sealing

	HEATING	COOLING	TOTAL	NATHERS RATING
Zero insulation	285.1	62	347.1	**1.5**
R1	161.6	26.1	187.7	**3.2**
R2	144.9	22	166.9	**3.5**
R5	132.3	18.5	150.8	**3.8**

Energy bills: heating and cooling

In line with the results for thermal efficiency modelled above, we calculated energy use and bills for heating and cooling in a range of scenarios.

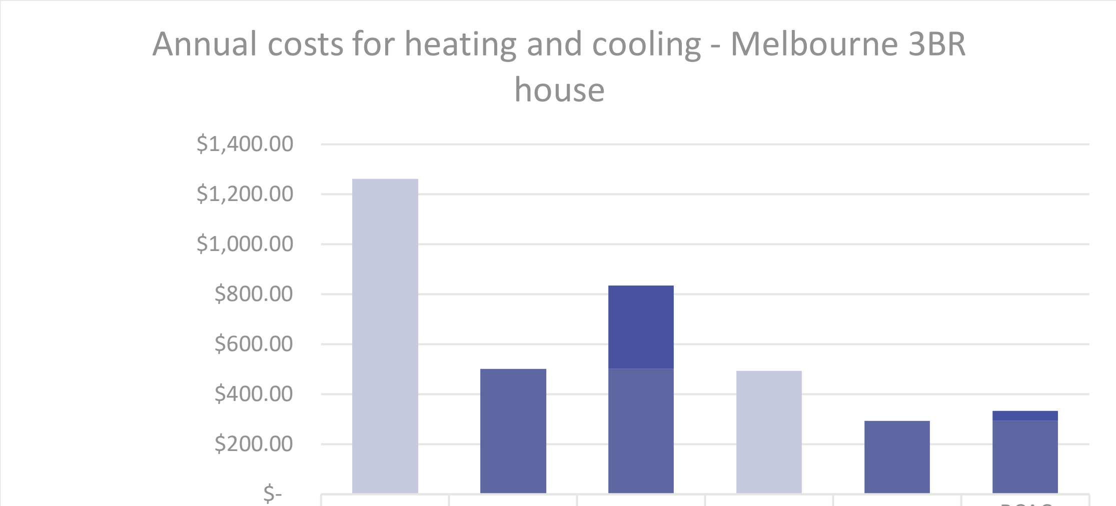
We used Renew's *Sunulator* energy simulation platform to model annual energy use. *Sunulator* simulates the operation of heating and hot water appliances and energy production from solar PV systems on a daily basis, creating half-hourly consumption and generation data over a year to estimate how much solar generation will be consumed onsite versus exported. Updated climate data files are used to calculate heating and hot water requirements and solar generation across the range of locations. The tool allows for detailed configuration of appliances, thermal efficiency and solar generation. Energy consumption of heating and hot water appliances is calculated from the gas or electricity input required to generate the same heat energy output.

In selecting scenarios, we aimed to assess the impact of phasing out gas heaters; requiring cooling; and setting standards for thermal efficiency including insulation and draught sealing. For the purposes of modelling, we have assumed a reverse cycle air conditioner with 2-star heating efficiency and 3-star cooling efficiency, in line with proposed minimum standards; while this is a possible configuration, we note that common models may be likely to have higher heating efficiency.

Scenarios:

SCENARIO	NATHERS RATING	HEATING	COOLING	INSULATION	DRAUGHT SEALING
Gas heating	1.3	Gas wall furnace	N/A	None	No
RCAC heating only	1.3	2 star RCAC	N/A	None	No
RCAC heating and cooling	1.3	2 star RCAC	3 star RCAC	None	No
Gas heating + thermal upgrade	3.8	Gas wall furnace	N/A	R5	Yes
RCAC heating only + thermal upgrade	3.8	2 star RCAC	N/A	R5	Yes
RCAC heating and cooling + thermal upgrade	3.8	2 star RCAC	3 star RCAC	R5	Yes

Annual costs for heating and cooling were modelled as follows:

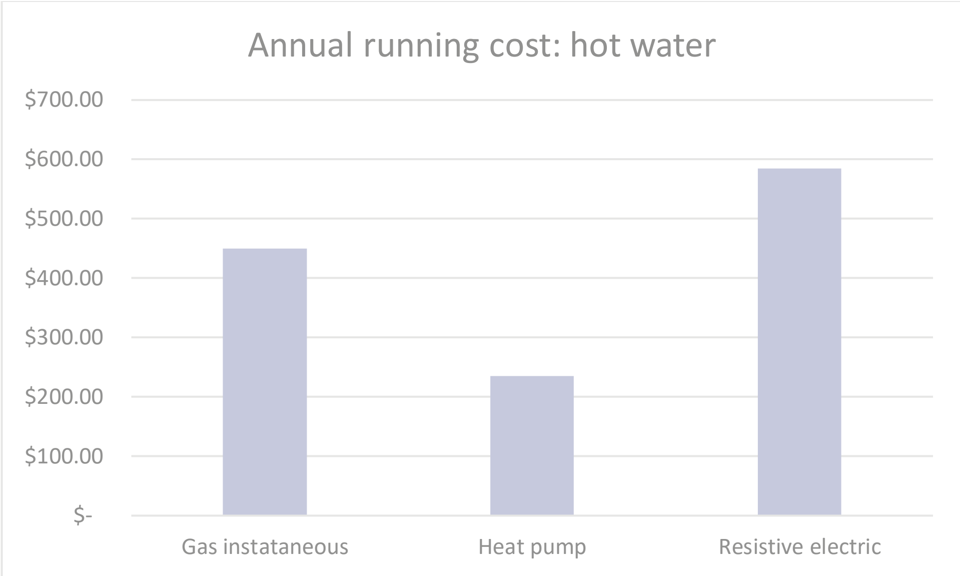


	Gas heating	RCAC heating only	RCAC heating and cooling	Gas heating (insulation + draught sealing)	RCAC heating only (insulation + draught sealing)	RCAC heating and cooling (insulation + draught sealing)
Electricity bill $ (cooling)	$-	$-	$332.72	$-	$-	$39.47
Electricity bill $ (heating)	$-	$501.52	$501.52	$-	$293.80	$293.80
Gas bill $	$1,263.38	$-	$-	$492.54	$-	$-

The high cost of gas heating was found to result in significantly higher overall heating and cooling costs, even where cooling was added to a household. Rental households replacing a gas wall furnace heater with a reverse cycle air conditioner at even a relatively low efficiency rating experienced lower bills for heating, as well as the additional option of cooling. Cooling costs were significantly lower for homes with ceiling insulation and draught sealing, indicating a benefit to ensuring thermal efficiency measures are undertaken alongside installation of reverse cycle air conditioning.

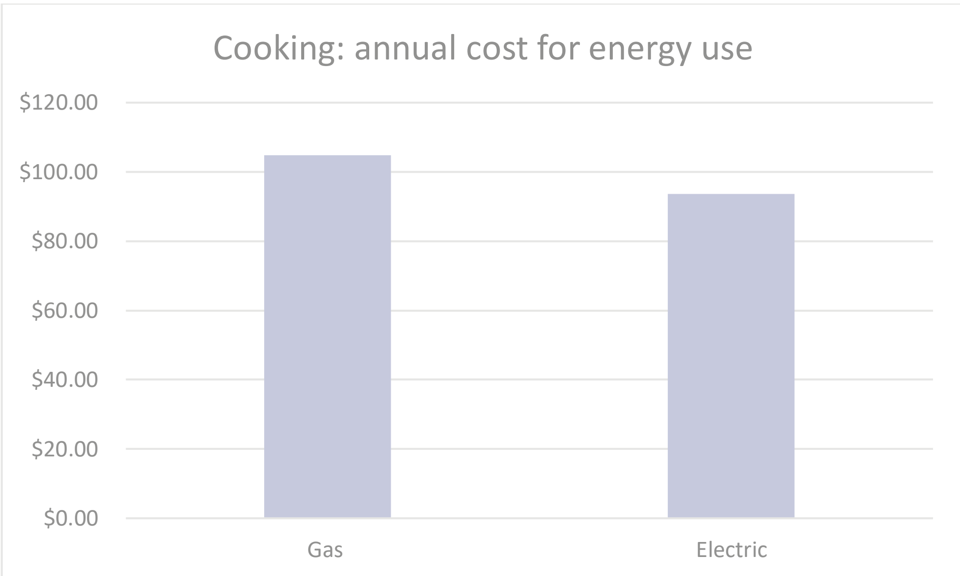
Bills: hot water

The proposed regulations require gas hot water systems to be replaced with electric hot water systems at the end of life. This measure is important to support electrification objectives in line with the Gas Substitution Roadmap and removes a factor that may disproportionately lock renters into gas use. Running costs for heat pump hot water systems are significantly lower than gas or resistive electric systems, though can vary significantly between models, household behaviour, access to solar and other factors. Renew's modelled costs used in this analysis, based on current tariffs and typical behaviour for a household of three, are as follows:



Bills: cooking

Cooking uses a smaller amount of energy than heating, cooling or hot water, and is not considered in the proposed minimum standards. While the direct usage cost of energy for cooking is relatively low (see chart below), a risk is that many renters will remain connected to gas networks due to the presence of gas cooktops and will therefore continue to pay daily service charges. **Current costs of daily connection fees to gas based on July 2024 tariffs are $340 per year, which are not accounted for in the figures below.** (A further important issue not considered in the proposed changes or RIS is the significant health impact of indoor gas use. Renew has not estimated the societal or household cost of health impacts from indoor gas for the purposes of this analysis.) Figures below compare gas stove and oven with induction and electric oven.

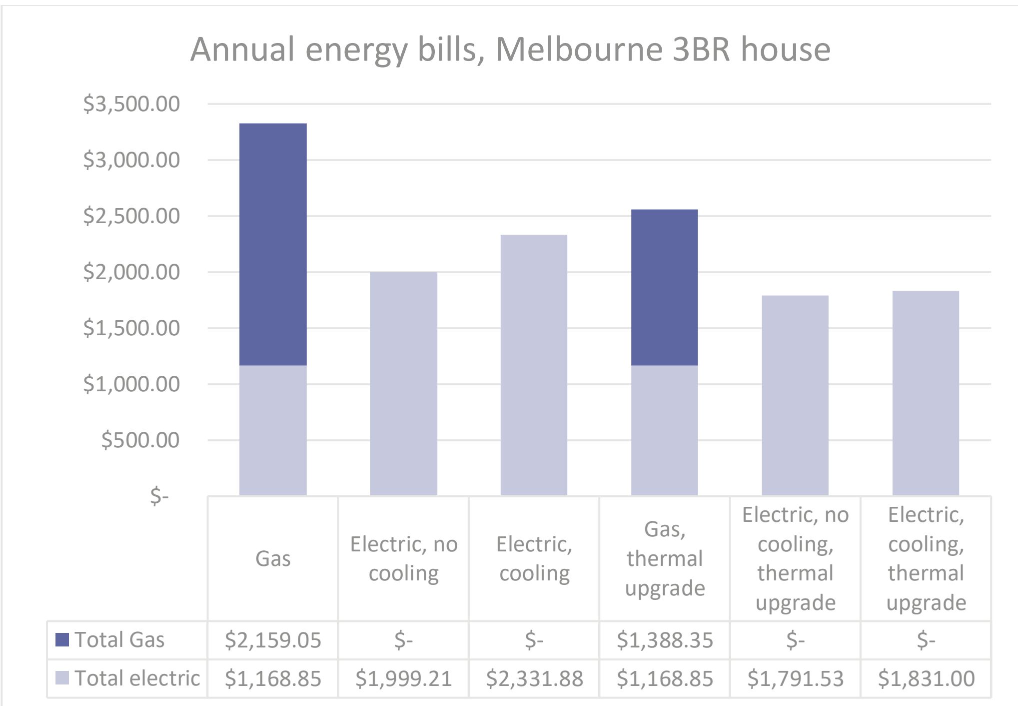


Total annual household energy bills

Drawing on the above scenarios alongside an assumed average electricity use for plug-in appliances (assumed here at an average 7.9 kWh per day), we have calculated expected annual energy bills for gas and electricity across a range of relevant scenarios.

SCENARIO	NATHERS RATING	HEATING	COOLING	HOT WATER	COOKING	THERMAL
Gas	1.3	Gas wall furnace	N/A	Gas instant	Gas	No insulation or draught sealing
Electric, no cooling	1.3	RCAC 2 stars	N/A	Heat pump	Induction	No insulation or draught sealing
Electric, cooling	1.3	RCAC 2 stars	RCAC 3 stars	Heat pump	Induction	No insulation or draught sealing
Gas, thermal upgrade	3.8	Gas wall furnace	N/A	Gas instant	Gas	R5, draught sealing
Electric, no cooling, thermal upgrade	3.8	RCAC 2 stars	N/A	Heat pump	Induction	R5, draught sealing
Electric, cooling, thermal upgrade	3.8	RCAC 2 stars	RCAC 3 stars	Heat pump	Induction	R5, draught sealing

Total annual energy bills were as follows. It should be noted that bills include a daily connection charge for electricity and for gas where present; based on current tariffs in July 2024 these were calculated at $426 for electricity annually and $340 for gas annually.



Homes with gas appliances were found to be more expensive to run in all cases, including when compared to homes using cooling (unavailable to residents in the scenarios with gas heating only). Homes with thermal upgrades (insulation and draught sealing) had the lowest energy bills; for thermally upgraded homes, the additional cost of turning on cooling (using the same reverse cycle air conditioner as used for heating) was found to be less than $40 per year.

Household level cost-benefit and payback periods

A general principle of residential energy efficiency is that upgrades have an upfront cost but ongoing benefit in the form of energy bill savings, typically paying for themselves over time. However, in the case of rental homes, the upfront cost is paid by landlords while bills are paid by tenants. This means that there may be a lower incentive for a landlord to make upgrades, and while tenants might be motivated to seek upgrades, they don't have the necessary leverage to ensure that they happen. This is known as a problem of split incentives.

In this analysis we compare upfront costs with energy bill savings to determine a payback period. We note that benefits primarily accrue to renters.

We use the scenario of a home with gas appliances and no insulation or draught sealing as a baseline. Costs of upgrades are drawn from assumptions provided in the consultation RIS. (Additional rebates favouring energy-efficient or electric appliances may result in reduced costs but are not included in our analysis.) These costs are as follows:

Thermal efficiency:

- Cost of R5 insulation for 130m2 home including labour: $2,184
- Cost of draught sealing (moderate level) including labour: $437.01
- Total cost of thermal upgrades under proposed regulations: $2,621.01

Hot water

- Additional cost for heat pump over basic gas instantaneous system upon replacement: $2,169

Heating/cooling

- Cost of purchasing and installing reverse cycle air conditioners is lower than fixed wall gas heaters. Cost **saving** for a 3-star cooling RCAC over a gas wall heater is $142 ($2,563 and $2,705 respectively). This indicates that not only is the end-of-life replacement of gas heaters with reverse cycle air conditioning a benefit to renters, but also to landlords.

Additional costs may be incurred for capping of gas lines or meters; this is assumed at $300 in the Regulatory Impact Statement (RIS) put out for consultation by the Victorian Government, while possible full abolishment costs (where required) are now capped at $220 in Victoria. In our view the annual saving on connection fees of $340 clearly strengthens the benefits to renters of electrification; a broader policy consideration is whether this connection fee should be the responsibility of renters or landlords.

Scenarios considered for cost-benefit analysis:

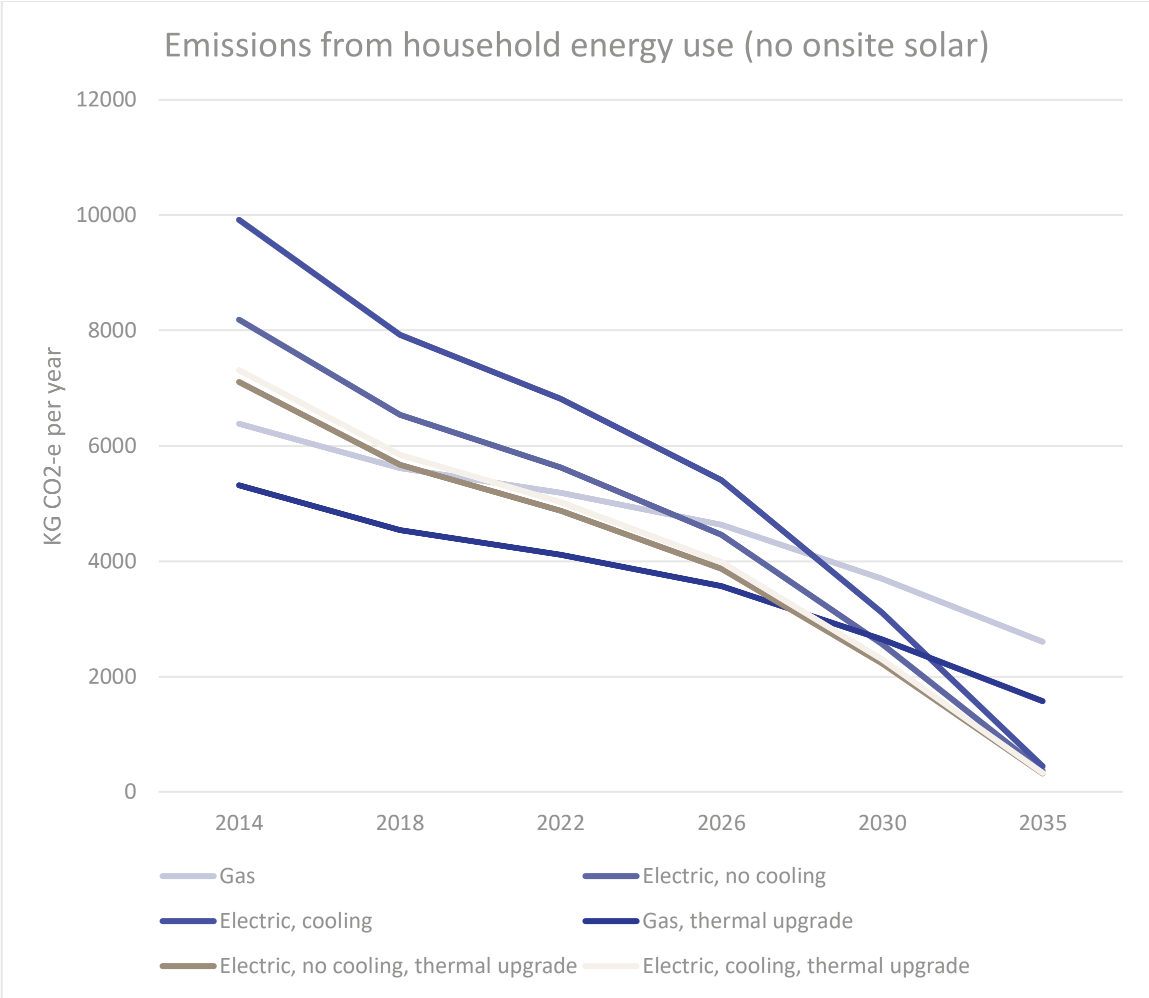
MEASURE	UPFRONT COST	ANNUAL SAVING	YEARS TO PAY BACK UPFRONT COST
Installation of insulation and draught sealing	$2621	$770.84	3.4
Installation of insulation, draught sealing, and net cost of reverse cycle air conditioner over gas wall heater (no cooling)	$2479	$969.58	2.6
Installation of insulation, draught sealing, and net cost of reverse cycle air conditioner over gas wall heater (with cooling)	$2479	$930.11	2.7
Replacement of gas hot water with heat pump at end of life	$2169	$215.42	10.0
Replacement of gas hot water with heat pump at end of life (if final gas appliance; inc gas disconnection and removal of gas daily fees)	$2469	$555.42	4.5

Greenhouse gas emissions

Applying the energy usage amounts for gas and electricity in the scenarios above, we have analysed the annual greenhouse gas emissions from household energy use. The emissions intensity of electricity in Victoria's grid is declining as brown coal generation has been replaced by a growing share of renewables. Victoria has committed to 95% renewables by 2035 and DCCEEW projects electricity in Victoria to produce virtually zero emissions by 2035 (0.01kg CO_2-e per kWh). As such, we have applied historical and projected emissions intensity factors in line with Victorian government renewable energy targets. **The analysis presented here assumes no rooftop solar**. Homes using electricity generated onsite both reduce energy costs for a household and emissions for electricity use.

Our findings show that whereas a decade ago homes using gas appliances produced lower overall emissions than homes with all-electric appliances, the growing share of renewables means this is no longer the case. Over time, emissions from using electric appliances will continue to decline. With a lifespan of around 15 years (using the Victorian Energy Upgrades program estimate), a new gas appliance will have significantly higher lifetime emissions than a new electric appliance.

Thermal efficiency measures such as insulation still have an impact on household emissions by reducing energy use. While the direct emissions intensity of energy consumption is projected to decline for all-electric homes, reducing energy loads in homes at peak times through efficiency is likely to have important benefits for the energy grid, allowing faster penetration of renewables and associated decarbonisation.



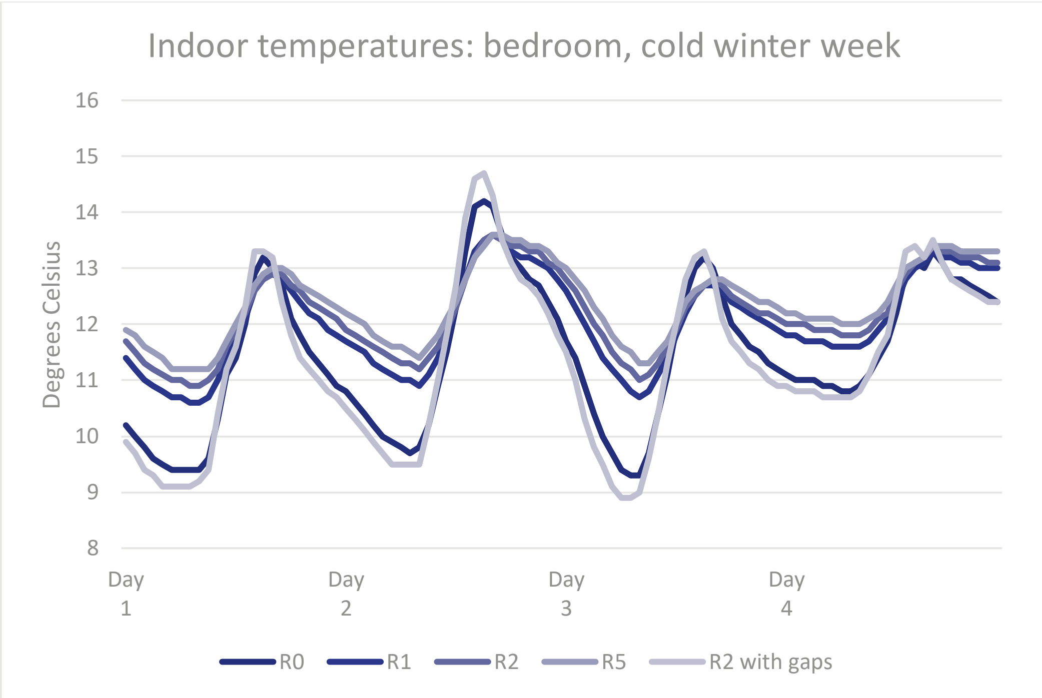
Indoor temperatures

We modelled indoor temperatures in a bedroom across different thermal efficiency scenarios based on levels of insulation. These temperatures are modelled using FirstRate5 software. It is important to note that these results **assume no heating or cooling is used** (calculated using 'free running mode' in FirstRate5). In practice, many or most households can be expected to use heating and cooling where available and therefore would not experience the temperatures modelled here. However, this remains an important consideration for minimum standards. First, even where a fixed heater or air conditioner are present, many households will not always switch them on due to concerns about energy costs; better thermal efficiency can make a significant difference in indoor temperatures for these households. Second, the temperatures modelled here are for a bedroom, where a fixed heater or air conditioner are not proposed as minimum requirements. Third, the temperature readings act as a proxy for the additional costs of heating and cooling for households that do use these appliances.

We modelled households with no insulation, R1, R2, and R5. To account for the problem of homes with incomplete, older or poorly installed insulation, we also modelled a home with gaps in ceiling insulation in some areas (including above the bedroom for which temperatures are modelled). Hot and cold outdoor temperatures are selected from Typical Meteorological Year weather files used in the calculation of NatHERS ratings.

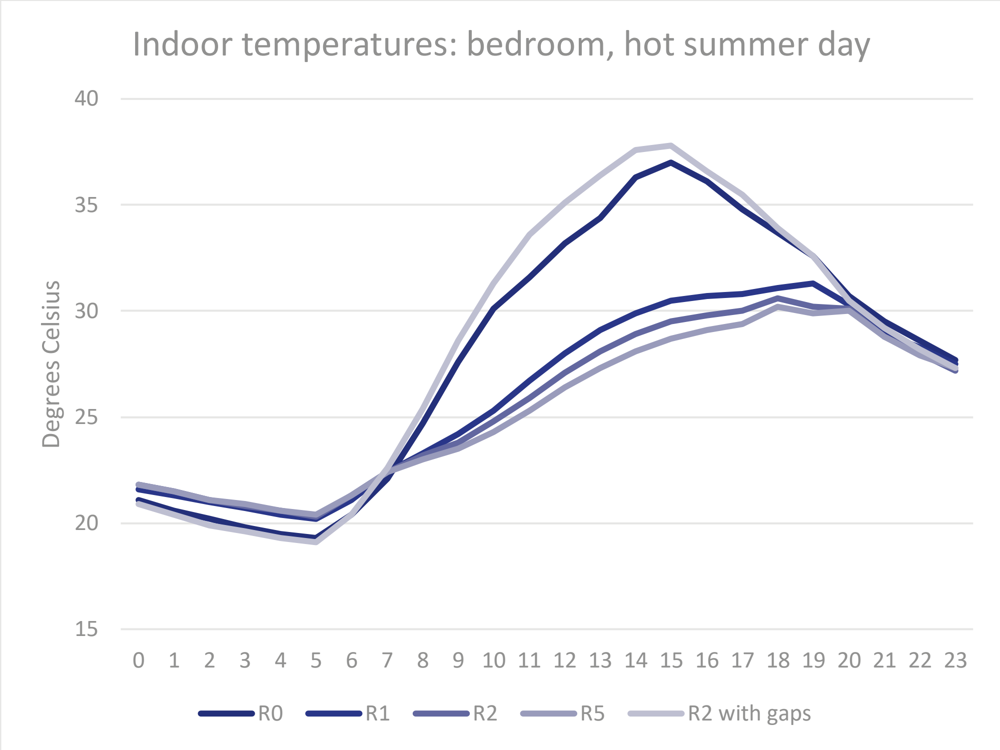
In a **cold winter week**, we found that homes with no insulation experience significantly colder overnight temperatures than homes with insulation. Homes with R5 insulation experienced the least severe minimum temperatures, while homes with complete R1 and R2 insulation also experienced relatively moderated temperatures. Critically, homes with gaps in insulation experienced similar minimum temperatures as homes with no insulation.

Minimum indoor temperatures fell to a minimum of 8.9 degrees in homes with no or poor insulation, compared to 11.2 degrees in a home with R5 insulation. Outdoor temperatures in the selected dates fell to a minimum of 5.4 degrees. By comparison, the World Health Organisation considers 18 degrees as a minimum indoor healthy temperature.



On a **hot summer day** with a maximum outdoor temperature of 39.3 degrees, the presence of insulation also made a significant difference to indoor temperatures. Maximum indoor temperatures were modelled to reach 37 degrees with no insulation and 37.8 degrees with gaps in insulation, compared to a maximum of 30.2 degrees in the home with complete R5 insulation.

The high temperatures experienced within even insulated homes indicates the importance from a health and comfort perspective of the availability of cooling. The effectiveness and energy efficiency of air conditioning to achieve comfortable temperatures is greatly improved by insulation and other thermal efficiency measures.


Indoor temperatures: bedroom, hot summer day
40
35
30
25
20
15
Degrees Celsius
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
R0
R1
R2
R5
R2 with gaps

Assumptions

Tariffs

We have used tariffs based on an average of basic offers from three retailers available in July 2024 (Engie, Origin, Alinta). The following flat rate tariffs have been assumed:

Gas usage: 3.99c / MJ

Electricity supply charge: 25.75c / kWh

Where applicable, the following daily supply charges have been used. Note that daily supply charges are not included in the usage costs for heating and cooling; while all households are expected to pay electricity supply charges, homes disconnecting from gas completely are no longer required to pay daily gas supply charges:

Gas daily supply charge: 93.37c

Electricity supply charge: 116.73c

Emissions

Emissions factors (referring to the emissions intensity of electricity and gas) have been sourced from the National Greenhouse Accounts Factors. Future projections of emissions intensity are based on Victorian government renewable energy targets. Electricity emissions intensity is declining and is projected to decline further as renewable energy generates an increasing proportion of electricity. Gas emissions for household consumption are expected to remain constant, with minor adjustments for distribution efficiency and/or avoided losses. Electricity emissions are calculated as Scope 2 + Scope 3; gas emissions are calculated as Scope 1 + Scope 3.

The following emissions factors have been used:

Year	Emissions factor electricity	Emissions factor gas	% renewables in grid
2014	1.34	55.23	13
2018	1.07	55.38	17
2022	0.92	55.53	24
2023	0.86	55.23	N/A
2026	0.73	55.53	40
2030	0.42	54.4194	65
2035	0.06	53.3088	95

renew.

552 Victoria St
North Melbourne VIC 3051
61 (3) 9639 1500
renew.org.au

ABN 57 533 056 318