



Leading in sustainability

Submission to: Department of Energy, Environment and Climate  
Action, Victorian Government

## Minimum Standards for Rental Properties and Rooming Houses

July 2024

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*, attendees 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 Australian Aboriginal and Torres Strait Islander people of this nation. We acknowledge the traditional custodians of the lands on which our organisation is located and where we conduct our work, and pay our respects to ancestors and elders, past and present. Renew is committed to honouring Australian Aboriginal and Torres Strait Islander people's unique cultural and spiritual relationships to the land, water and sea and their rich contribution to society.

**For further information, please contact:** [info@renew.org.au](mailto:info@renew.org.au)

A.B.N: 57 533 056 318  
Reg. No. A0017411T

-  
552 Victoria Street  
North Melbourne VIC 3051  
+61 (3) 9639 1500

Renew welcomes the opportunity to engage in consultation on the *Residential Tenancies and Residential Tenancies (Rooming House Standards) Amendment (Minimum Energy Efficiency and Safety Standards) Regulations 2024*.

**Renew strongly welcomes the Victorian government’s proposal to expand minimum energy efficiency standards for renters.**

All homes should be healthy and affordable to run. Making homes energy efficient and powering them with renewables reduces bills, improves health, reduces emissions, and makes homes more comfortable during weather extremes.

However, too often renters are locked out of these benefits. Rental homes have worse energy efficiency than owner-occupied homes. Nationally, one study found that poor energy efficiency leaves renters paying 8% more in energy bills compared to owner occupiers in similar homes.<sup>1</sup> A higher proportion of renters experiences energy stress than owner-occupiers.<sup>2</sup> Renters risk being left behind in the transition to clean, renewable electricity and locked into paying the costs of a declining gas network.

The poor energy efficiency and thermal comfort of rental homes is a structural problem of Australia’s rental housing market. Market-based responses to improving energy efficiency for renters are limited by the problem of ‘split incentives’: whereas landlords pay the upfront cost of energy improvements, energy bills are paid by tenants. Owner-occupiers have a clear financial incentive over time to invest in energy efficiency improvements due to reduced energy bills, whereas there is not a similar direct incentive to drive the behaviour of landlords. Furthermore, renters are not and should not be required to pay for the upfront costs of improvements; renters paying for energy efficiency improvements would not accrue capital benefits and do not have security of tenure to enjoy the ongoing benefits.

**Setting strong minimum standards for energy efficiency in rental homes is a key policy response to the structural barriers to healthy, energy efficient homes faced by renters.**

The expanded minimum standards proposed under this consultation position Victoria as a national leader. Of Australia jurisdictions, only the ACT has enacted minimum requirements for ceiling insulation. No other jurisdiction has set standards to ensure renters enjoy the benefits of draught sealing, cooling, or efficient electric appliances at the time of replacement.

The Victorian government must implement these proposals and provide clear signposts for renters and landlords on future standards and protections for renters in the energy transition.

**Renew has conducted an independent analysis of benefits to a typical rental household from the measures considered.**

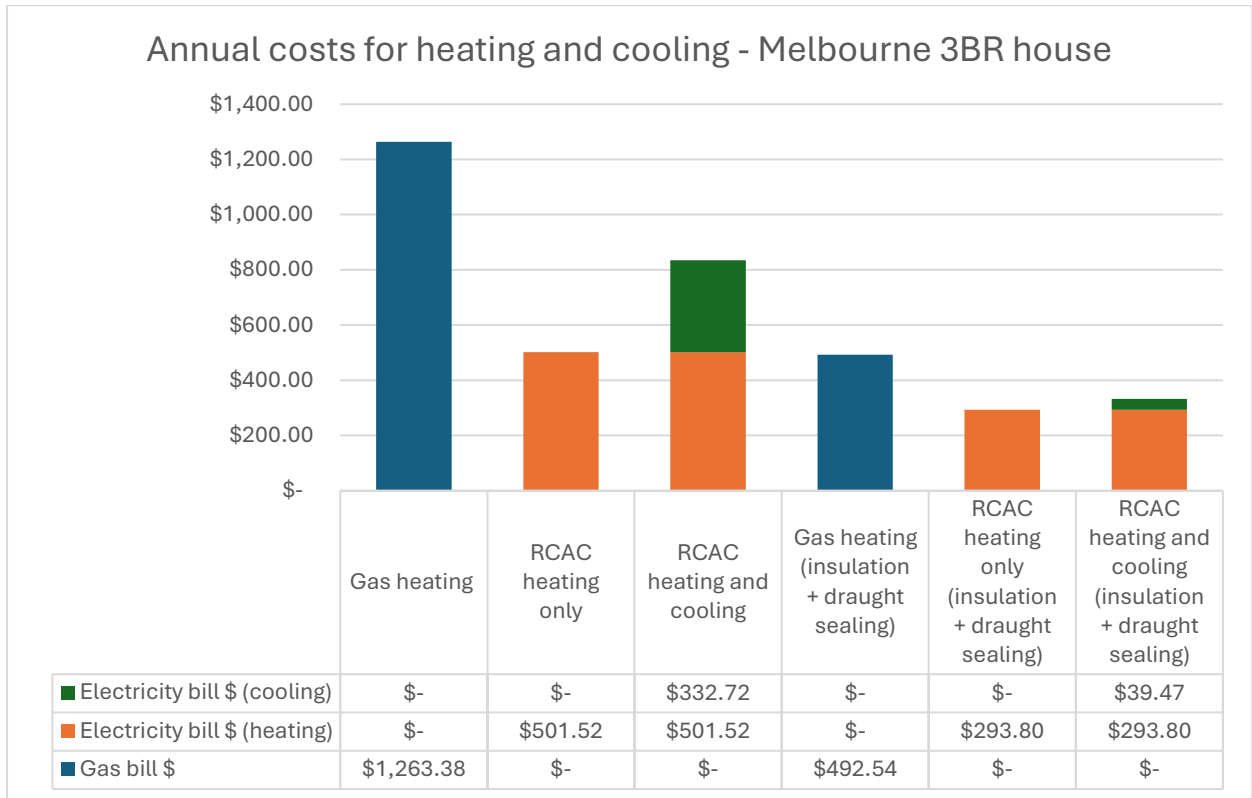
[A full summary of our analysis is provided as an appendix to this submission.](#) Key findings include:

---

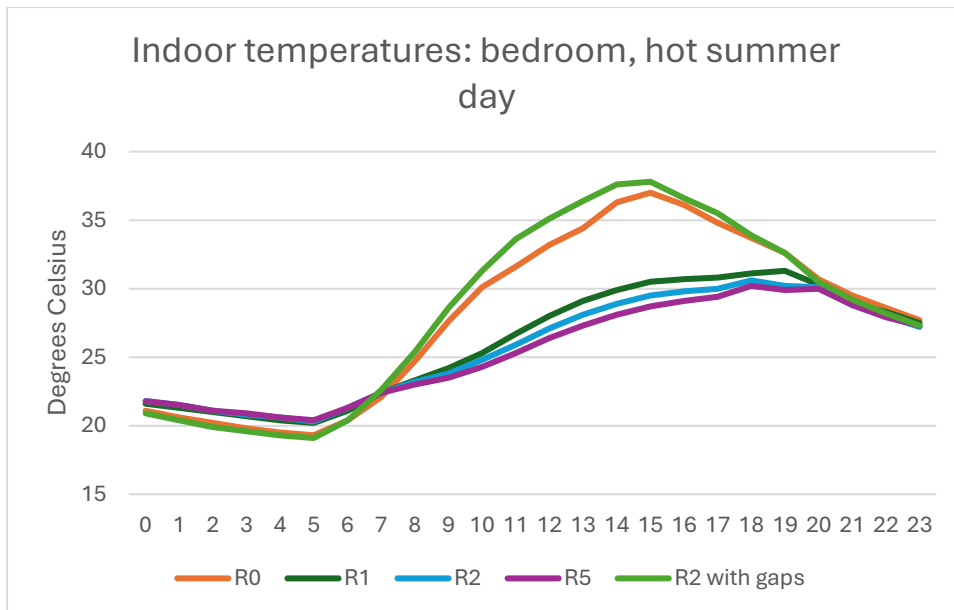
<sup>1</sup> [https://ccep.crawford.anu.edu.au/sites/default/files/publication/ccep\\_crawford\\_anu\\_edu\\_au/2022-05/ccep2202\\_best\\_burke.pdf](https://ccep.crawford.anu.edu.au/sites/default/files/publication/ccep_crawford_anu_edu_au/2022-05/ccep2202_best_burke.pdf)

<sup>2</sup> <https://www.bsl.org.au/research/publications/power-pain/>

- Requiring insulation and draught sealing reduced energy loads for heating and cooling by around 60%
- The cost of heating is significantly lower for homes with reverse cycle air conditioners, insulation, and draught sealing. In a Melbourne climate a home using reverse cycle air conditioning for heating *and* cooling spends less on energy than a home using gas for heating only.



- Emissions from electric appliances are declining rapidly and will result in lower emissions than gas appliances
- Well-installed insulation leads to more moderate temperatures in conditions of extreme weather



## Recommendations

### **Recommendation 1: Require ceiling insulation in all rental homes and require top ups to homes with low levels of insulation**

No home in Victoria should be without insulation. Insulation makes a critical difference to home comfort, temperatures, and energy use. Renew analysis finds that R5 insulation cuts hundreds of dollars a year off energy bills and minimises unhealthy indoor temperatures (see analysis in appendix). Our analysis finds that insulation is an important complementary feature for homes using reverse cycle air conditioning for cooling, also proposed as a mandatory minimum standard.

Ceiling insulation provides the most important energy savings and is typically easier and cheaper to install than wall or underfloor insulation in existing homes. Ceiling insulation is therefore an appropriate focus for minimum rental energy efficiency standards. The proposed level of R5 is both simple and broadly in line with National Construction Code requirements and is an appropriate standard.

We recommend that the insulation requirement should apply not only to homes with no insulation, but also to homes with low levels of insulation (option 3B in the consultation RIS).

The ACT minimum insulation standard sets a trigger level for top-up insulation, requiring homes with levels of existing insulation below R2 to install insulation in full compliance with minimum standards. In our view this approach provides the best model to protect Victorian renters. We are concerned that significant numbers of rented homes currently have poorly installed, ineffective or degraded insulation and will not be protected under the proposed standard.

The regulations as written appear to suggest that homes with any insulation present will not be required to install R5 insulation. We are concerned that renters in homes with significant gaps in insulation or degraded insulation will be unprotected (see analysis in appendix). We note that older homes are more likely to have degraded R1/R2 insulation. At an extreme, the proposed

regulations appear to open the possibility of hasty or poor installation of minimal insulation by landlords seeking to avoid the full installation of R5 insulation.

Proposed exemptions for installations with costs that are “significantly higher than the average” should be clearly defined and explained in order to provide certainty and to avoid gaming of exemptions by landlords.

A related consideration is the expected difficulty for many renters to identify the presence, absence, or quality of insulation in their home, particularly in homes with no access to ceiling spaces. Without external verification (such as Scorecard assessments, declarations by landlords or real estate agents, or verification using heat sensing cameras) there is a significant risk of non-compliance with the new minimum standard.

### **Recommendation 2: set minimum 3 star electric standard for heating and cooling**

Renew strongly supports the proposal to require cooling as a minimum standard, and to alter the definition of “energy efficient fixed heater” under the regulations in order to ensure that new heaters installed at the end of life are electric.

The requirements for cooling and electric heating are highly complementary as both can be achieved at low cost with a reverse cycle air conditioner. Subject to installation costs, new reverse cycle air conditioners are typically cheaper to purchase than fixed gas wall heaters, meaning that the measure provides straightforward benefits.

Our analysis finds that using reverse cycle air conditioners for heating and cooling leads to significantly lower energy bills than a gas wall heater (see appendix). Renters should not be locked in to gas use in a declining gas network; the proposed regulation to require electric replacements at end of life are an appropriate response. This is furthermore in line with Victoria’s Gas Substitution Roadmap and emissions reduction commitments, noting that further incentives and measures may be required to accelerate electrification.

Requiring cooling improves health outcomes and keeps homes safer under conditions of extreme heat. Supplementary measures beyond air conditioning can also make a significant improvement in resident comfort, including ceiling fans and passive features such as external shading and fly screens allowing for open windows. We recommend inclusion of these simple and low cost features within minimum standards.

We recommend the adoption of minimum heating energy efficiency standards beyond the current 2 stars (Option 3 in the consultation RIS). As identified in the consultation RIS, benefits to renters in avoided energy costs are increased under this option. Renew analysis conducted in 2019 at the time of the introduction of the heating minimum standard found that 4-star heaters are between 29-39% cheaper to run than a 2-star heater and that renters with a 4-star heater in a typical open-plan setting would save over \$100 a year relative to a 2-star heater. There is only a modest cost difference in purchase and installation between 2-star and higher efficiency heaters, with savings by renters from higher efficiency units outweighing costs to landlords over a period of 4-9 years.

### **Recommendation 3: require solar electric or heat pump replacements for hot water systems at end of life**

Renew supports the proposal to require low running cost electric replacements for hot water systems at end of life (option 4 in the consultation RIS). This measure will reduce usage costs for renters, avoid locking renters into the gas network for the lifespan of new appliances, and is consistent with the broader strategy outlined in the Gas Substitution Roadmap.

Exemptions are proposed in the exposure draft regulations include where costs are significantly higher than average, and class 2 homes (apartments and units) with shared centralised services. While we understand the rationale for exemptions based on unusually high costs, clarification and definition of these costs would provide greater certainty for tenants, for example in homes with limited space for heat pump storage tanks.

#### **Recommendation 4: require draught sealing in all rental homes**

Renew welcomes the proposal to require draught sealing as a minimum standard for rental homes. As outlined in the consultation RIS and in our analysis, this measure can result in improvements to comfort, health, and reduced energy use.

We recommend that Option 3 (High) should be implemented as a minimum standard. The relatively minor additional costs to landlords are outweighed by additional benefits in comfort and reduced energy use for renters.

Because of the varied nature of draughts and gaps, in our view renters would benefit from the complementary measure of independent guidance, advice and resources alongside the introduction of the minimum standard. We note that the varied nature of draughts and the definition of 'unreasonable' in the regulations may result in compliance challenges, which should be considered and monitored.

We support the proposed approach to exemptions for homes with flueless or open flued gas appliances as an important safety measure.

#### **Recommendation 5: ensure clear and effective compliance mechanisms**

A significant concern is the degree to which compliance will be enforced for any expanded minimum standards.

A general principle in ensuring compliance is that enforcement should not depend on complaints from renters exclusively. While some renters may be in a position to request upgrades – and will be placed in an improved position to do so with clear minimum legal standards – the power differential between renters and landlords means that many renters will be unable or unwilling to request compliance.

Independent verification through checks or real estate agent verification for new leases provide key opportunities for improved compliance. Further opportunities to strengthen compliance may become available in future with a framework for energy ratings disclosure (see recommendation 7).

The Victorian government should continue to engage and consult with renter advocacy groups to identify approaches to enforcement and compliance. Ongoing monitoring of compliance following the introduction of new minimum standards should be undertaken.

**Recommendation 6: require electric stovetops and ovens when replacing appliances at end of life**

While the current proposed measures ensure that gas heating and hot water will not be installed when replacing existing appliances at end of life, no such measure has been considered for gas cooking. We recommend that these proposals should be extended to replacement cooking appliances, which would enable more rental homes to come off the gas network completely.

Cooking typically uses significantly less energy than other major fixed appliances. However, homes using gas stoves or ovens remain connected to the gas network and are liable for daily connection fees currently costing over \$300 per year. As renters do not have agency over the choice of replacement appliances, we are concerned that without regulations requiring electric replacements many renters will be left paying the costs of a declining gas network.

**Recommendation 7: signpost future integration of performance-based ratings in minimum energy efficiency standards**

Victoria should plan for future measures to integrate performance-based home energy efficiency ratings into minimum energy efficiency standards for renters. Victoria's current regulations follow a 'features-based' approach, in which regulations are set for a range of specific energy features (e.g. insulation, heating, cooling, hot water systems, etc). An alternative approach that has been successfully implemented internationally is a 'performance-based' approach, in which a minimum energy efficiency rating using an agreed ratings system is set below which a home cannot be leased.

This approach would be highly consistent with current policy development of a national framework for home energy ratings disclosure. Ratings for new and existing homes using NatHERS whole-of-home, existing home, Residential Efficiency Scorecard ratings, or other consistently applied ratings frameworks may be applied and disclosed under an agreed framework. The enactment of a requirement for mandatory disclosure of home energy ratings at the point of sale or lease would greatly expand access to ratings and ensure that newly leased homes would undergo an energy assessment

This approach has clear benefits. Assessments (for example using the Residential Efficiency Scorecard) would provide clear information to renters and allow for the assessment of existing features that are difficult for renters to verify alone, such as identifying gaps in insulation. In-home assessments can also provide clear information on measures that can be taken to improve efficiency. Mandatory minimum ratings would allow for simplified compliance pathways, independently verified. A minimum acceptable rating can also be ratcheted up over time with clear signposting, ensuring the energy performance of rental homes is improved over time in line with emissions commitments and community need in the energy transition.

We recommend that the Victorian government enables future implementation of a ratings-based minimum standard for rental homes, and clearly communicates this future approach to ensure certainty for landlords and renters.

**Recommendation 8: shift the responsibility for gas supply charges from tenants to landlords**

A major strategic theme of the proposed minimum standards is ensuring that renters are included in the broader shift towards residential electrification and are not left paying the costs of a declining gas network. In our view, an important complementary systemic measure is shifting the responsibility to pay daily gas connection fees from tenants to landlords, while usage costs would continue to be paid by tenants. This approach already exists for water billing.

Renters are unable to respond to financial incentives to replace fixed gas appliances. Placing the onus for gas connection fees on landlords would substantially shift incentives when making decisions for replacement appliances, including accelerating the replacement of ageing appliances, encouraging full abolishments, and providing an incentive to electrify even in cases where exemptions exist. It would furthermore shift incentives on replacement decisions for gas cooking appliances, which are not currently covered in the proposed minimum standards.



## Appendix: summary of Renew household analysis

This appendix provides a summary of key findings from analysis conducted by Renew in relation to proposed minimum energy efficiency standards for renters in Victoria. The analysis considered the impacts and benefits of proposed minimum rental standards at the household level. Findings of the analysis include:

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

### 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 130m<sup>2</sup> with 90m<sup>2</sup> 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/M<sup>2</sup> per year, in line with standard NatHERS practice.

### Results

#### Without draught sealing

	Heating	Cooling	Total	NatHERS rating
Zero insulation	310.1	67	377.1	<b>1.3</b>
R1	186.6	31.1	217.7	<b>2.8</b>
R2	169.9	27	196.9	<b>3</b>
R5	157.3	23.5	180.8	<b>3.3</b>

#### With draught sealing

	Heating	Cooling	Total	NatHERS rating
Zero insulation	285.1	62	347.1	<b>1.5</b>
R1	161.6	26.1	187.7	<b>3.2</b>
R2	144.9	22	166.9	<b>3.5</b>
R5	132.3	18.5	150.8	<b>3.8</b>

## 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.

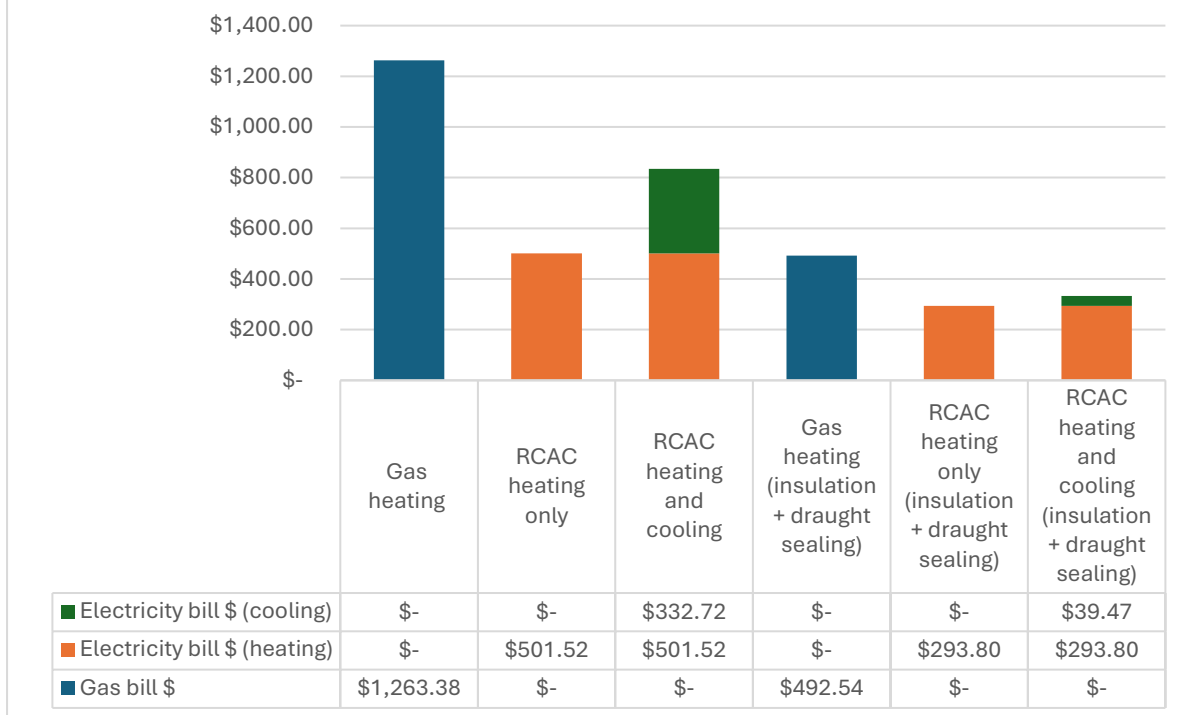
In selecting scenarios we aimed to assess the impact of phasing out gas heaters; requiring cooling; and setting standards for thermal efficiency including insulation and draught sealing. For the purposes of modelling, we have assumed a reverse cycle air conditioner with 2-star heating efficiency and 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:

<b>Scenario</b>	<b>NatHERS rating</b>	<b>Heating</b>	<b>Cooling</b>	<b>Insulation</b>	<b>Draught sealing</b>
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:

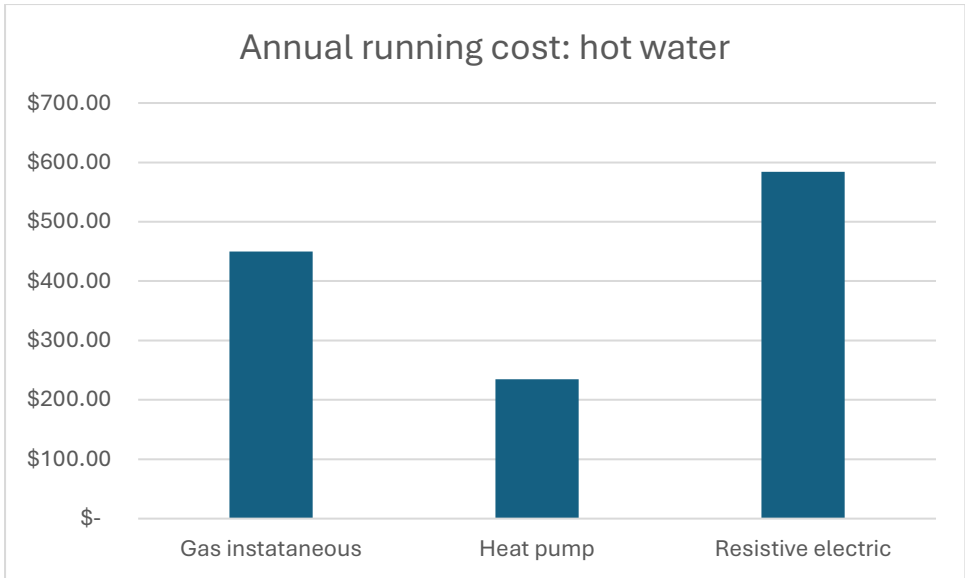
### Annual costs for heating and cooling - Melbourne 3BR house



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.

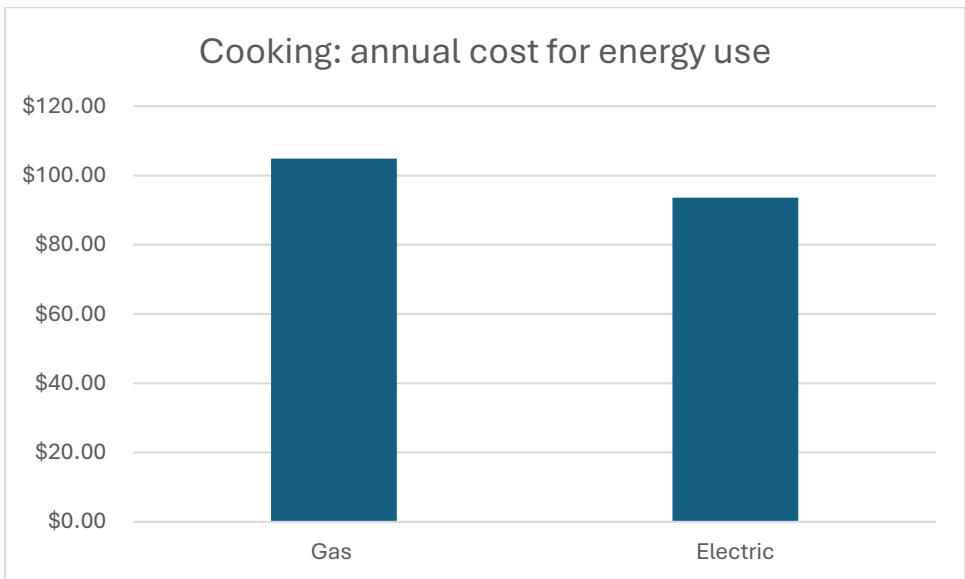
### Bills: hot water

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.

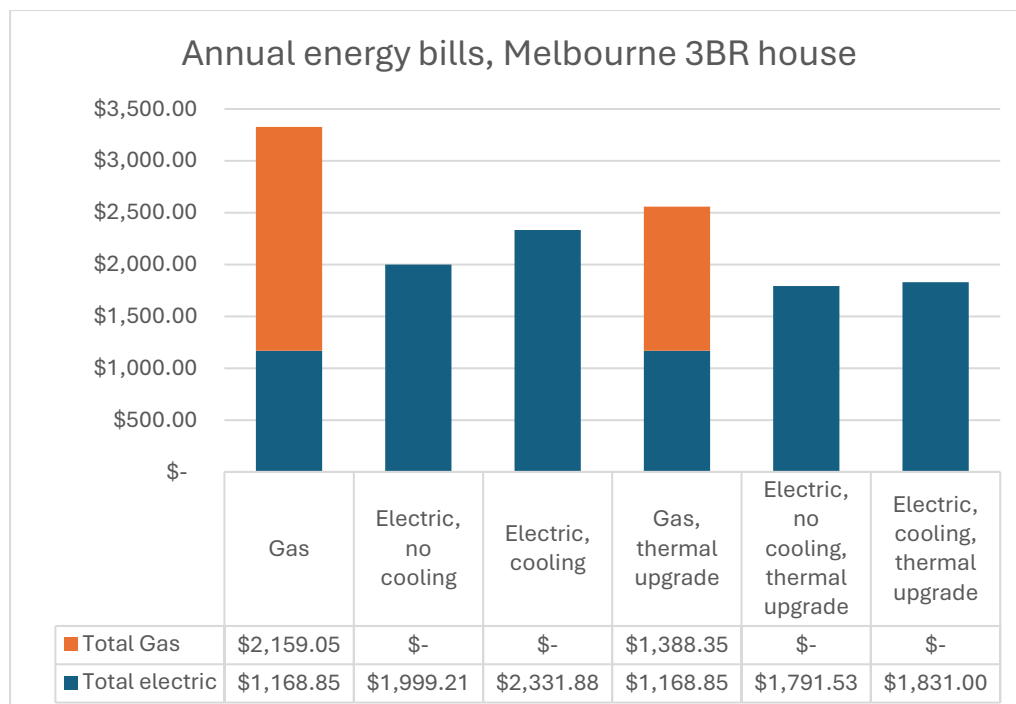


## Total annual household energy bills

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, leading to 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. These costs are as follows:

Thermal efficiency:

- Cost of R5 insulation for 130m<sup>2</sup> 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 consultation RIS, while possible full abolishment costs (where required) are 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 (see recommendations).

Scenarios considered for cost-benefit analysis:

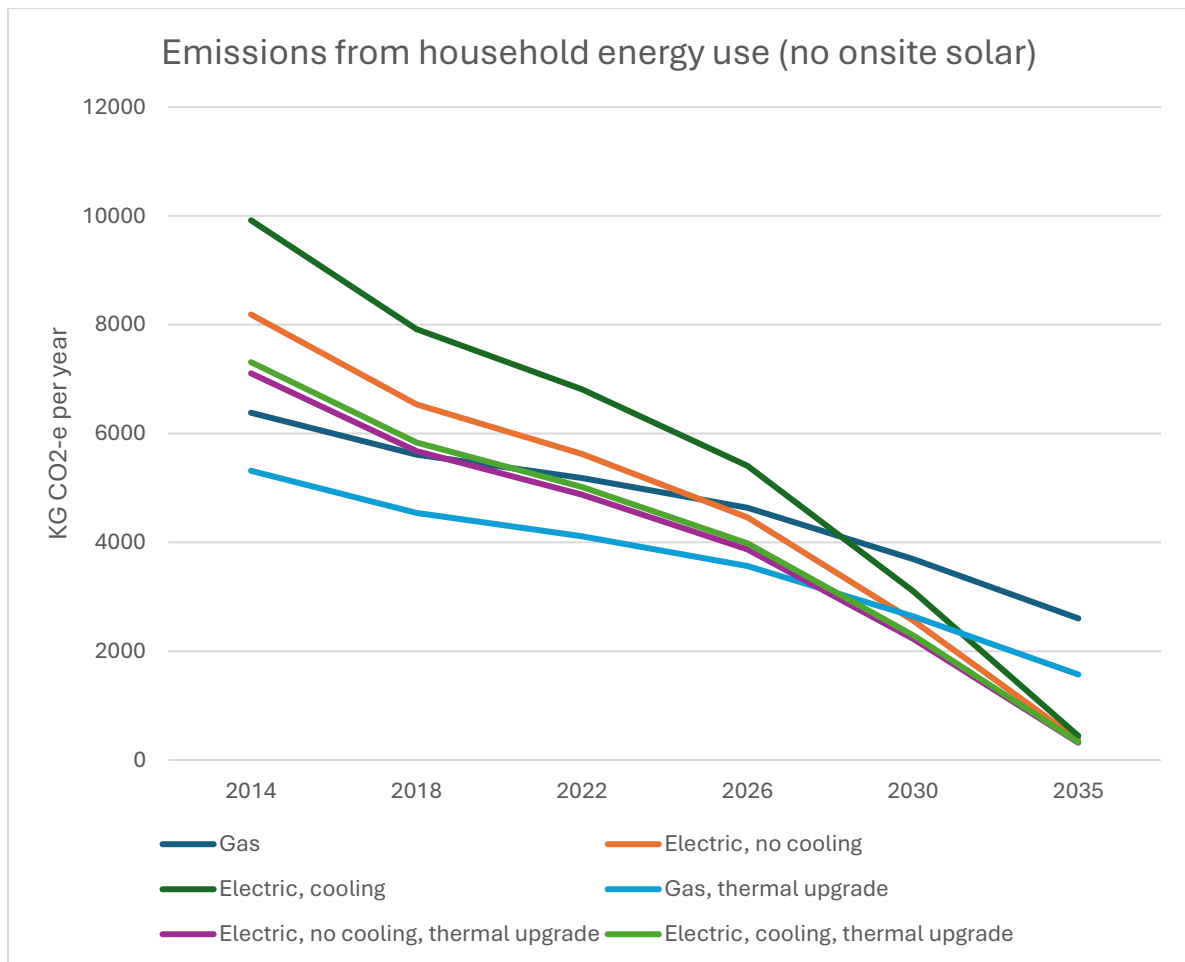
Measure	Upfront cost	Annual saving	Years to pay back upfront cost
<i>Installation of insulation and draught sealing</i>	\$2621	\$770.84	3.4
<i>Installation of insulation, draught sealing, and net cost of reverse cycle air conditioner over gas wall heater (no cooling)</i>	\$2479	\$969.58	2.6
<i>Installation of insulation, draught sealing, and net cost of reverse cycle air conditioner over</i>	\$2479	\$930.11	2.7

<i>gas wall heater (with cooling)</i>			
<i>Replacement of gas hot water with heat pump at end of life</i>	\$2169	\$215.42	10.0
<i>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)</i>	\$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. 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 Scope 2 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.



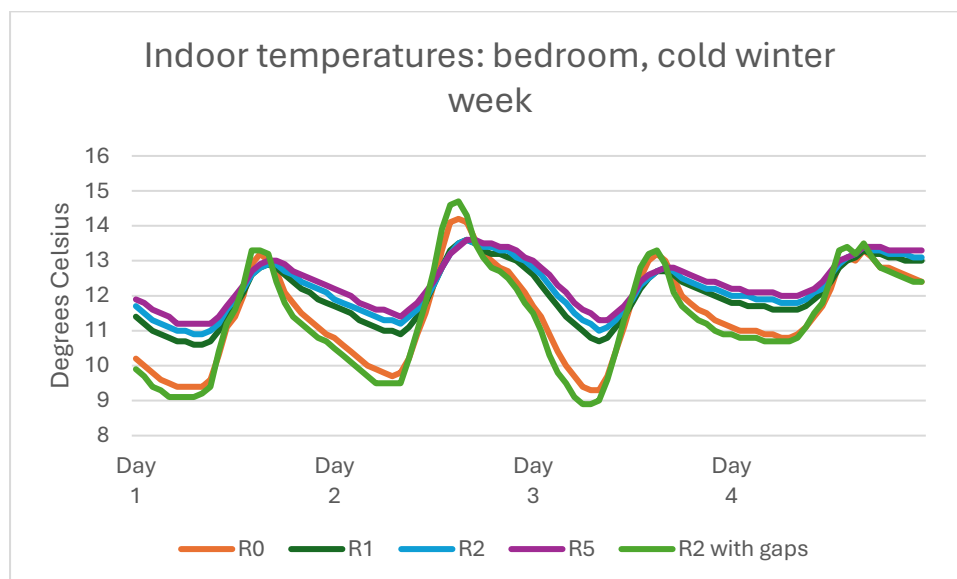
## Indoor temperatures

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.

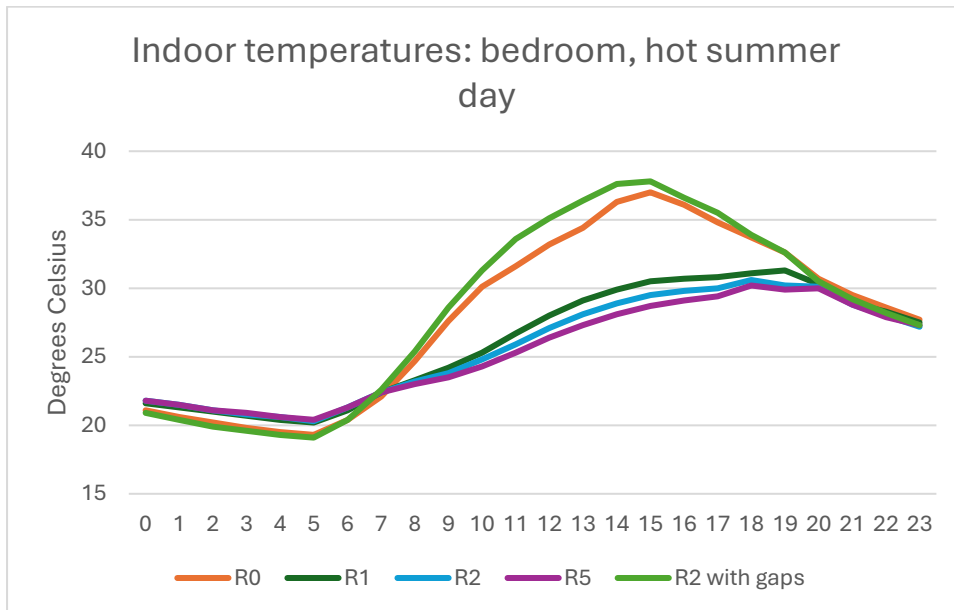
Minimum indoor temperatures fell to a minimum of 8.9 degrees in homes with no or poor insulation, compared to 11.2 degrees in a home with R5 insulation. Outdoor temperatures in the selected dates fell to a minimum of 5.4 degrees. By comparison, the World Health Organisation considers 18 degrees as a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



## 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