ACIL ALLEN

6 September 2021

Report to Environment, Planning and Sustainable Development Directorate

Minimum standards for residential rental properties

Regulation Impact Statement

About ACIL Allen

ACIL Allen is a leading independent economics, policy and strategy advisory firm, dedicated to helping clients solve complex issues.

Our purpose is to help clients make informed decisions about complex economic and public policy issues.

Our vision is to be Australia's most trusted economics, policy and strategy advisory firm. We are committed and passionate about providing rigorous independent advice that contributes to a better world.

Suggested citation for this report

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Figures

Tables

Boxes

Executive summary

Insulation R value
The R-value of ceiling insulation is a measure of the ability of insulation to resist heat flow. R5 is a grade of roof insulation commonly used in new builds and considered a cost-effective option in the Canberra climate.

Energy efficient heater
An electric heat pump heater such as a reverse cycle air conditioner (which can also provide cooling in summer).

Energy performance tool ratings
For the purposes of this analysis, the Victorian Residential Scorecard was assumed to be the rating tool for this standard. Using this tool, a 3-star rating corresponds to a dwelling having average energy costs and a 2-star rating corresponds to a dwelling having energy costs twice the average.

Social Cost of Carbon
The social cost of carbon (SCC) tries to estimate the marginal impact of an additional tonne of carbon based on the future costs associated with those emissions. This analysis uses a medium SCC scenario discounted at 3 per cent derived from research by the United States Interagency Working Group.

Rental properties with poor thermal control place burdens on tenants — they spend more on keeping their household comfortable, which puts pressures on their household budgets, or live in conditions that are uncomfortable or unsafe, which impacts their wellbeing and health. The burden of poor thermal control falls disproportionally on renters from low-income households, concession card holders, those with a disability, aged renters, and households with children.

Evidence nationally and provided by ACT residents is that rental premises have poorer thermal control and therefore energy efficiency than owner-occupier premises. The main driver of this gap is the split incentive problem — where those who have ownership and control of the property do not benefit directly from investing in improving it, as the benefits are primarily captured by tenants.

This Regulatory Impact Statement (RIS) has considered the potential impacts of the following options to remedy the problem of low energy efficient rental properties:

— a minimum standard for roof insulation of R3 or R5
— a minimum standard for an energy efficient heater
— a performance standard requiring a minimum rating of 2 stars or 3 stars.

It is important to note that there are different energy savings, different numbers of properties affected, and different outcomes for tenants associated with each of these options.

What the analysis shows

ACIL Allen analysed five minimum standards, each with a two- and four-year phase in period. All of the insulation options have a positive value to the ACT community, using a 3 per cent discount rate and social cost of carbon. The heater and performance standard options would result in a net cost to the community, though all options provide a positive return on average at the household level to renters in upgraded properties (see Table ES 1).

Table ES 1 Headline results, economy wide analysis, three per cent discount rate

Option modelled	Benefit-cost ratio (BCR)	Net present value ($m)
a) Insulation R3 - 2 year	1.19	$10.4
b) Insulation R3 - 4 year	1.21	$11.1
c) Insulation R5 - 2 year	1.29	$17.4
d) Insulation R5 - 4 year	1.30	$18.0
e) Heater - 2 year	0.59	-$15.6
f) Heater - 4 year	0.59	-$15.6
g) Performance 2-stars - 2 year	0.46	-$13.0
h) Performance 2-stars - 4 year	0.47	-$12.9

Option modelled	Benefit-cost ratio (BCR)	Net present value ($m)
i) Performance 3-stars - 2 year	0.49	-$107.0
j) Performance 3-stars - 4 year	0.50	-$104.1

Note: All impacts are calculated in present value (using a three per cent discount rate) over the life of the upgrades.
Source: ACIL Allen

The number of rental properties that have to be upgraded vary between options. We estimate the scale of each option is approximately:

— insulation (R3 or R5): 18,450 rental properties
— heater: 8,450 rental properties
— performance standard (2-star): 3,270 rental properties
— performance standard (3-star): 22,940 rental properties.

The 3-star performance standard options had the greatest energy and greenhouse gas emissions savings, followed by R5 insulation (see Table ES 2).

Table ES 2 Energy and greenhouse gas emissions saved over the life of the upgrade

Option modelled	Energy saved (PJ)	Greenhouse gas emissions saved CO_2-equivalent (tonnes)
a) Insulation R3 - 2 year	4,860	237,159
b) Insulation R3 - 4 year	4,830	237,165
c) Insulation R5 - 2 year	5,908	288,907
d) Insulation R5 - 4 year	5,872	288,914
e) Heater - 2 year	1,589	68,813
f) Heater - 4 year	1,574	68,925
g) Performance 2-stars - 2 year	760	39,668
h) Performance 2-stars - 4 year	771	40,733
i) Performance 3-stars - 2 year	7,021	396,647
j) Performance 3-stars - 4 year	7,136	406,187

Note: The energy savings are in total, over the entire life of the upgrades, which vary in each scenario.
Note 2: Greenhouse gas emissions saved only relate to domestic burning of gas and firewood. The ACT has moved to 100 per cent renewables (through the use of offsets) for its electricity grid.
Source: ACIL Allen

All of the options entail some rental providers of residential properties that require an upgrade to make up-front investments in energy efficiency improvements.

For those able to pass on the costs of the upgrade as increased rent, the minimum standard options are unlikely to have sizable impacts on the rental returns of an average rental provider: likely in the order of a fraction of a percentage point over the life of the asset. However, it is important to note that some will find it difficult to pass on this cost on in the short-term.

Impacts on tenants are likely to be positive for tenants for all options, mainly through reduced energy costs. Even with full cost pass through as increased rents, the R5 insulation options provide the highest net benefit to tenants (See Table ES 3).

Table ES 3 Household level impacts for upgraded tenancies (in present value)

	With no cost pass through	With full cost pass through	
Option modelled	Household benefit	Rent passed through	Net benefit
a) Insulation R3 - 2 year	$8,914	-$2,070	$6,844
b) Insulation R3 - 4 year	$8,825	-$2,032	$6,794
c) Insulation R5 - 2 year	$10,819	-$2,388	$8,431
d) Insulation R5 - 4 year	$10,712	-$2,349	$8,362
e) Heater - 2 year	$8,162	-$3,189	$4,973
f) Heater - 4 year	$8,042	-$3,174	$4,868
g) Performance 2-stars - 2 year	$10,566	-$4,650	$5,916
h) Performance 2-stars - 4 year	$10,612	-$4,635	$5,976
i) Performance 3-stars - 2 year	$13,813	-$7,531	$6,282
j) Performance 3-stars - 4 year	$13,900	-$7,506	$6,394

Note: All impacts are calculated in present value (using a three per cent discount rate) over the life of the upgrades.
Source: ACIL Allen

The preferred option – roof insulation

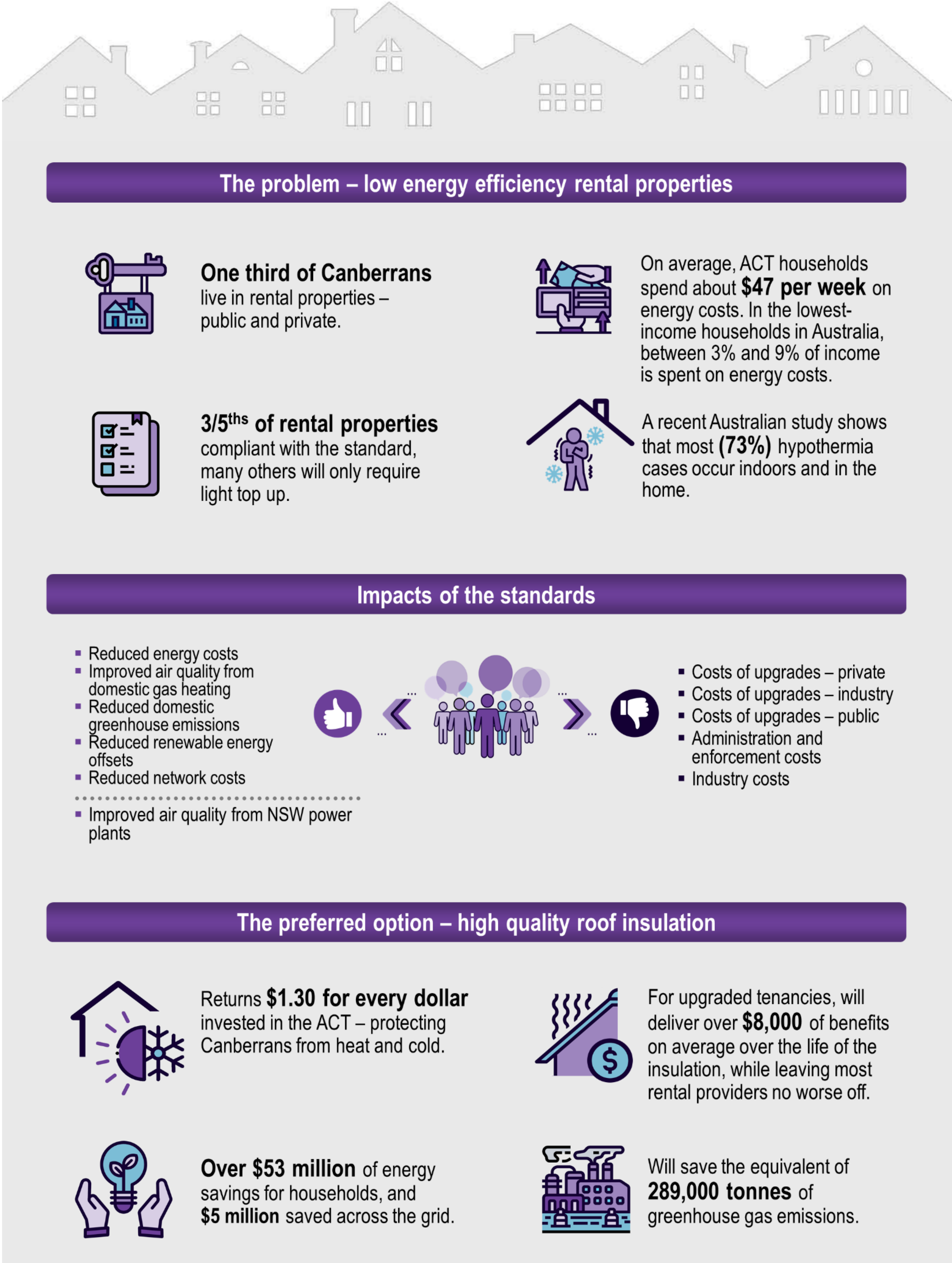
Based on the analysis undertaken for this RIS, the preferred option is a minimum standard for roof insulation (R5) for residential rental properties. The impact analysis shows that this minimum standard, with a four-year phase-in, would provide around $18 million in benefits for the ACT — shared across the community, including rental providers and tenants. The analysis shows that for every one dollar spent on the minimum standard, it returns $1.30 to the community.

The R5 roof insulation option also provides the highest net benefit to tenants — in excess of $8,300 on average over the life on the upgrade — while leaving rental providers no worse off where they can pass through the costs in full.

An R5 roof insulation minimum standard is expected to save 5,800 petajoules of energy over the period analysed and 289,000 tonnes of greenhouse gas emissions from domestic burning of gas and firewood.

The case for the preferred option is outlined in Figure ES 1.

Figure ES 1 A summary of the preferred option – R5 roof insulation for rental properties



Source: ACIL Allen

Introduction 1

The ACT Government remains a leader in the management of carbon emissions and energy usage. Since 1 January 2020, the ACT has decarbonised its electricity source, having met its target for 100 per cent of electricity consumed to be generated from renewable sources. The remaining major sources of carbon emissions include household energy use (gas and wood) and transport.

Energy use by households, whether sourced from electricity or other energy sources, is also a substantial source of stress on many household budgets.

The 2019 ACT Climate Change Strategy outlines the ACT Government's direction for further reducing emissions and delivering benefits across the ACT community. The Strategy includes the goal of a 'staged minimum energy performance for rental properties to come into force in 2022-23'. This goal can lower energy use (and costs) for renters, further reduce carbon emissions, and provide health and wellbeing benefits. As with all regulation, introducing minimum energy efficiency standards for rental properties has the potential to impose high costs on the community — especially on rental providers who may not be able to recoup those costs fully.

The *ACT Legislation Act 2001* requires the preparation of a Regulation Impact Statement (RIS) whenever a proposed regulation is likely to impose an appreciable cost on the community, or a part of the community. In light of this, the Environment, Planning and Sustainable Development Directorate (the Directorate) engaged ACIL Allen to prepare the RIS for the proposed regulations. The RIS will consider three broad policy options for the implementation of the regulation.

In developing this RIS, a range of inputs have been used to identify the policy options and to consider the potential impacts of the policy options. These include:

— a workshop with the Directorate on 25 March 2021 to develop the potential policy options
— stakeholder consultations, including interviews and workshops from 12 April to 29 April (see Appendix E)
— a survey of tenants, rental providers and owner-occupiers (see Appendix F).

The RIS is structured as follows:

— the nature and extent of the problem is described in Chapter 2
— the policy rationale and the case for government action are outlined in Chapter 3
— the range of policy options identified to address the problem, and those which are investigated in detail, are given in Chapter 4
— the impacts of the policy options are considered using a cost-benefit analysis in Chapter 5
— implementation and review considerations are given in Chapter 6
— a recommendation statement and conclusion of findings is given in Chapter 7.

The problem 2

Residential rental properties are relatively less energy efficient and insulated than non-rental properties. The result of this difference is that tenants have relatively more costly and less safe living conditions. Tenants and renters[1]:

— have greater impacts on their health in hot and cold weather
— have higher energy costs
— produce increased carbon emissions through higher energy use
— have lower amenity and comfort.

These impacts are further felt throughout the community in environmental and health costs. Very often, poor energy-efficiency and thermal control mean that tenants have to decide between energy savings and the health and comfort of their household.

This chapter outlines the evidence on the nature and extent of the problems associated with poor thermal comfort in rental properties. It explores:

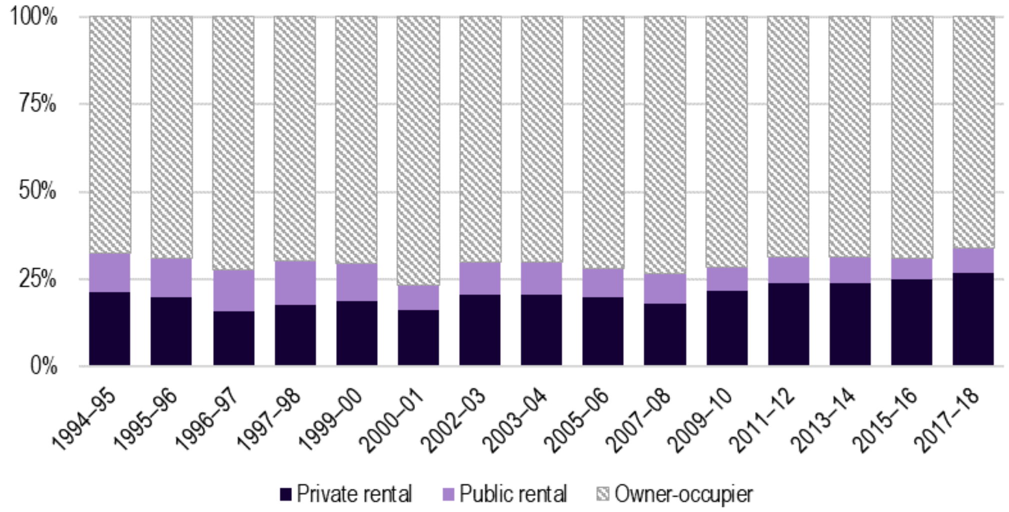
— the Canberra housing stock, and the rental stock in particular
— the evidence for the importance and prevalence of thermal comfort features in the rental stock
— the costs of poor thermal comfort in the rental stock, including the energy costs, environmental costs, amenity costs and health costs.

2.1 The rental housing stock

More Canberran households are in rental properties than ever before. In the twenty years to 2017-18, the number of households in private rental properties almost doubled to 40,559. In 2017-18, more than one in four — 26.1 per cent — households were renting in the private market, an increase of 5 percentage points from 1994-95. Including public housing, one third — 34.1 per cent — of households were not living in properties they own in 2017-18, which is a similar proportion to 1994-95 (see Figure 2.1).

[1] Where renters are those tenants who pay rent, and some tenants have fully subsidised or pay no rent, though do not own their place of residence.

Figure 2.1 Breakdown of tenure and residential rental provider type, Canberra, 1994-95 to 2017-18



Source: ABS, 4130.0 – Housing Occupancy and Costs, Australian Capital Territory, 1994-95 to 2017-18

2.1.1 Thermal control in rental properties

The ability to control the temperature of a residency is crucial for comfort and amenity, limiting energy costs, and subsequent health impacts on residents. To provide healthy and comfortable housing, tenants need the ability to control heating, cooling and ventilation. This control stems from thermal control features available at a residential property, including:

— insulation
— heating
— cooling
— shading, for example external window shades or thick curtains
— controlled airflow through draught proofing and ventilation control.

These thermal control features contribute to the energy efficiency of the property as well as the comfort and amenity to the tenants. In summer, these features work to cool houses. In winter, these work to keep houses warm.

These features work in concert, with a combination necessary to keep houses comfortable. For example, in an average sized uninsulated home, approximately 25-35 per cent of heat loss is through the ceiling (Energy Efficiency Council and Australian Sustainable Built Environment Council, 2021; Insulation Australasia, 2019); while up to 25 per cent of heat loss in winter months comes through uncontrolled draughts (Sustainability Victoria, 2016). Accordingly, all of these features are necessary. For example, adding energy efficient heaters to a draughty house is much less effective compared with adding energy efficient heaters to a well-sealed house.

Thermal control features in rental properties

There are no recent widespread studies into the prevalence of ceiling insulation, draught sealing, and energy efficient heaters and coolers in the Canberra housing stock. Surveys suggest that experiences of thermal control features are mixed — though, is likely worse in rental properties, and much worse in low-income rental properties.

ACIL Allen asked Canberran residents about the perceived energy-efficiency of their property (see Appendix F). On a scale from 0 to 10, tenants rated the energy efficiency of their property as 3.63

on average — almost half rated their property between 0 and 3. Only eight per cent rated their property 8 or above. In comparison, owner-occupiers rated their property as 5.12 on average.

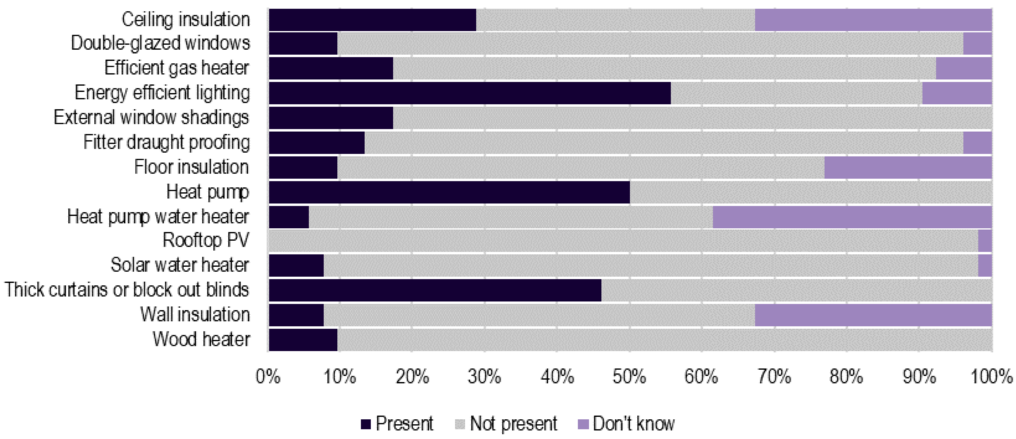
In 2016, the Victorian Government commissioned research into the experience of tenants. While the majority of tenants have positive experiences (as much as 73 per cent of tenants), results were worse, however, among concession card holders and those with a disability or health condition (64 per cent and 54 per cent, respectively) (EY Sweeney, 2016). According to a 2018 CHOICE survey, as much as 36 per cent of tenants had trouble keeping their home cool or warm (CHOICE, 2018).

The housing stock in Australia is relatively poor, in terms of thermal control. The Residential Efficiency Scorecard provides verified information on the energy efficiency of residential properties in Victoria, which has similar climate conditions to the ACT, though a generally older housing stock. In the 2019 report of results from 1,870 scorecard assessments, the data show (Victorian Residential Efficiency Scorecard Team, 2019):

- **85 per cent of properties had the worst possible rating for cooling** during hot weather, suggesting it is expensive or impossible to cool these properties. The most common issues identified were poor insulation, draughtiness and no external window shading.
  - 20 per cent of properties had no fixed cooling.
- **75 per cent of properties had low or very low ratings for keeping warm** during cold weather, where poor insulation and low air tightness (draughts) were the major cause.
  - 29 per cent of properties used a very low or low efficiency heater.
- **41 per cent of properties had ceiling insulation of R1.5 or less**, with 8 per cent of properties with no ceiling insulation installed whatsoever.

The Scorecard analysis is consistent with our survey of ACT tenants. According to the responses, energy efficient features and appliances are available in some rental properties though not in all. Around half of rental properties had common features like energy-efficient lighting, heat-pumps, or thick curtains. However, less than 10 per cent had double-glazed windows, now a very common energy efficient fitting in newer buildings (see Figure 2.2).

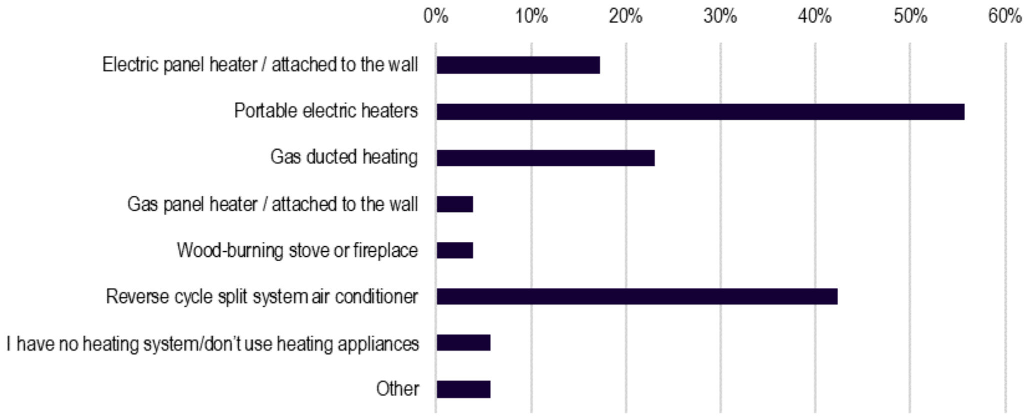
Figure 2.2 Energy efficient features and appliances in rental properties



Source: ACIL Allen

Heating and cooling in rental properties is commonly energy-inefficient. A relatively large portion (73 per cent) of tenants heat their homes using less efficient resistance heating. The second most common form of heating is reverse-cycle split system air conditioners. Only 27 per cent of tenants used gas heating appliances (see Figure 2.3). Approximately 60 per cent of tenants use portable electric fans to cool their homes. Approximately the same proportion of tenants use air conditioner units to cool their homes as do heat them (44 per cent).

Figure 2.3 Method for heating rental properties



Source: ACIL Allen

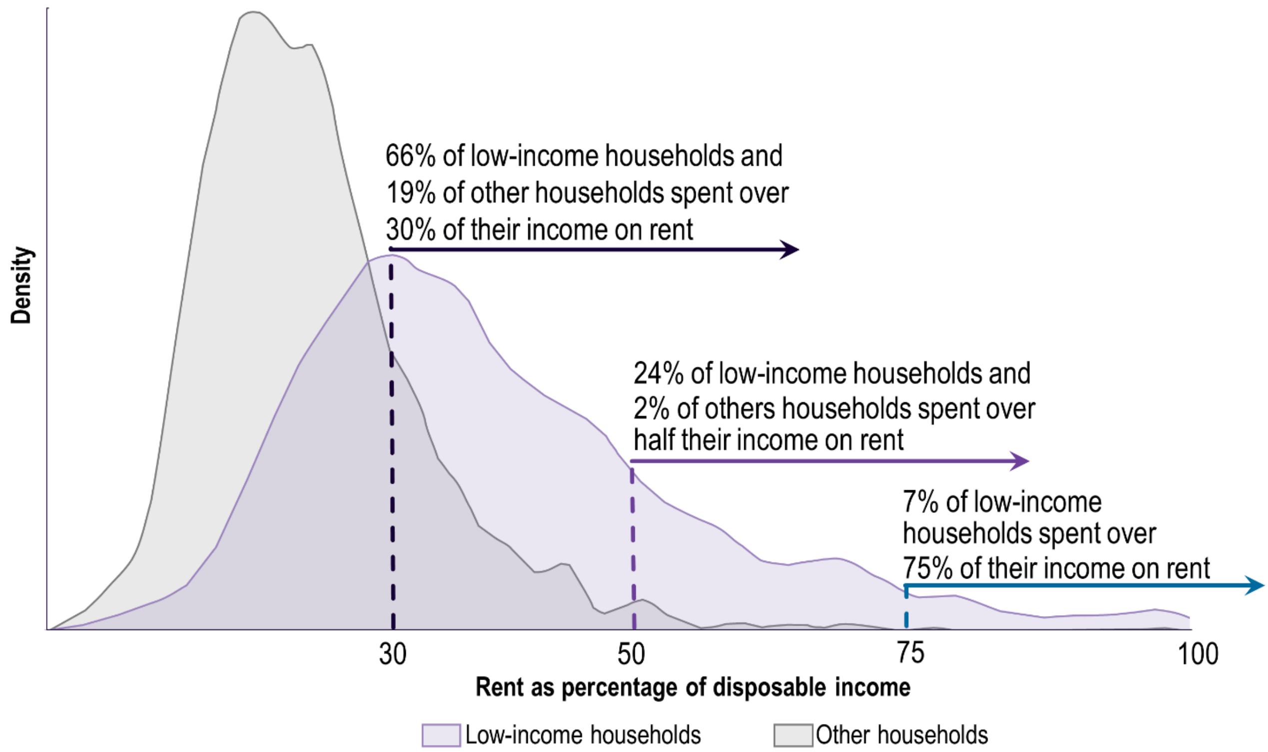
A lack of investment in energy-efficient fittings and appliances has a direct impact on comfort, health and energy bills. A 2018 survey (Newgate Research) also found that almost two-thirds (63 per cent) of Victorian tenants had some barrier to maintaining a comfortable temperature, 58 per cent had difficulties heating or cooling their home, and 31 per cent reported that they were unable to cool or heat their homes because of cost in the last couple of years. Results were worse for tenants with children, with 74 per cent having difficulty heating or cooling, and 40 per cent having avoided heating or cooling due to costs.

2.2 Energy costs to tenants

The less a tenant can passively control the temperature — through insulation, controlled ventilation and shading — the more that heaters and coolers need to operate to reach a desired temperature. Likewise, the more energy efficient a heater or cooler the less energy is needed to reach the same temperature. Houses without good thermal control features necessarily use more energy to be safe and comfortable. This increased energy use comes with increased energy costs, which has important impacts on household budgets.

Paying for accommodation is a major household expense, including for tenants. In the December 2020 quarter, households paid a median rent of around $560 per week for a three-bedroom house in Canberra — more than any other capital city (CMTEDD, 2020). Canberra's lowest income households are more likely to be private tenants than owner occupiers. Likewise, private tenants are more likely to have lower weekly incomes — about 82 per cent of the weekly incomes of owner-occupiers in 2017-18. In 2017-18, 66 per cent of low-income private rental households spent over 60 per cent of their income on rent while a quarter spent more than half of their incomes on rent (ABS, 2019) (see Figure 2.4).

Figure 2.4 Distribution of rent-to-income ratios, 2017-18



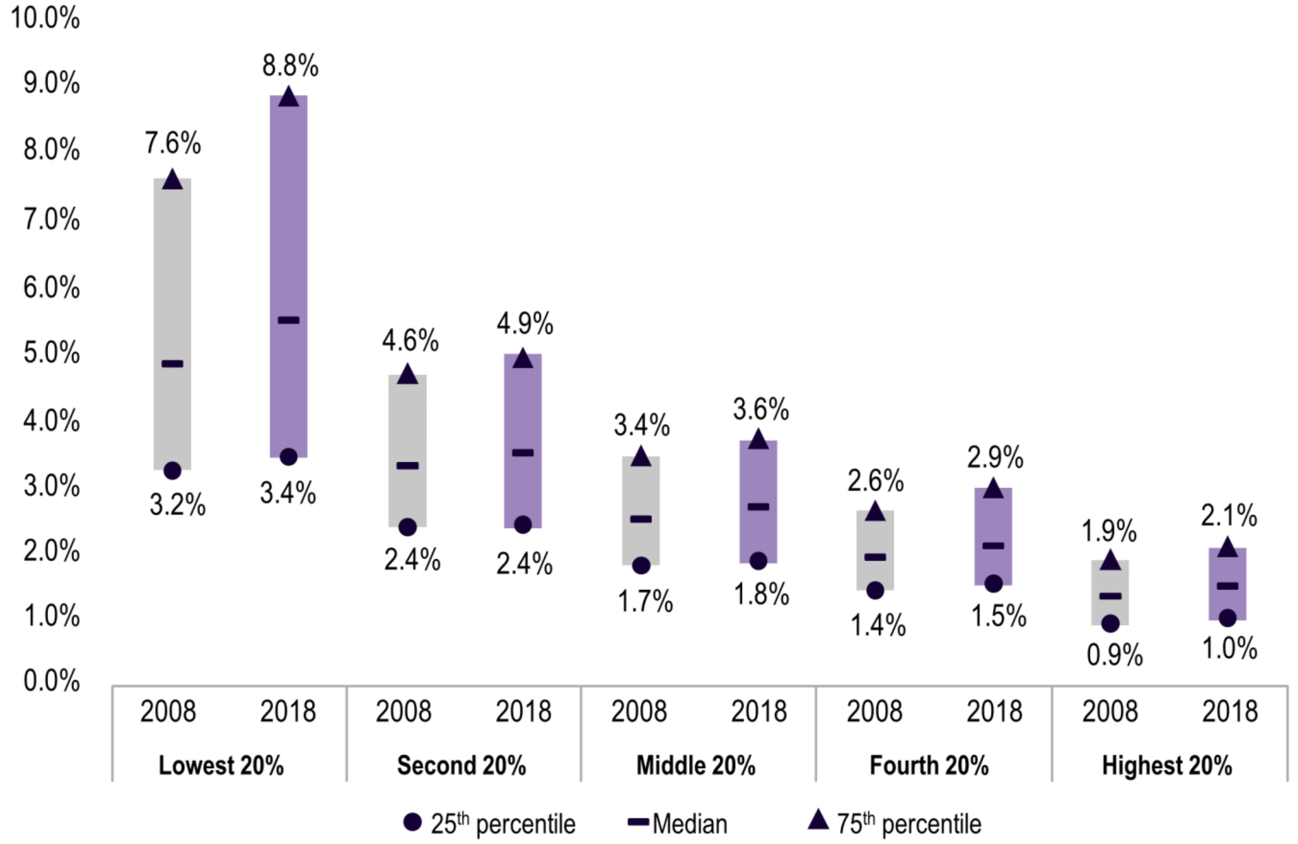
Note: The figure shows how the distribution of rent-to-income ratios varies across low-income and other households. The area under the line for each group sums to one.
Source: (Productivity Commission, 2019)

At the household-level, energy use is a major expense, costing each Australian household approximately $43 per week on average, of largely unavoidable costs (ABS, 2021). According to the Australian Household Expenditure Survey, the cost of domestic fuel and power increased by 28.5 per cent in nominal terms between 2009-10 and 2015-16. This category includes both electricity, and heating fuels like gas and wood.

In Canberra, household expenditure on energy in 2015-16 ranged from $42.22 per week for the lowest quintile to as high as $56.21 per week, with an average of $46.80 per week. This compares to other jurisdictions in which the costs range from $35.20 per week (in Brisbane) to $49.54 per week (in Darwin). Across Australia, this varies between 2.3 and 3.7 per cent of total weekly household spending.

The energy bill burden is even more pronounced for low-income households — which are disproportionately tenants — where energy costs can make up a larger portion of the household's income. Of those households in the lowest income quintile, a quarter were spending more than 8.8 per cent of their income on energy. And of those on Newstart, and similar allowances, a quarter were spending more than 9.7 per cent of their income on energy use (Phillips, 2018). Rising energy costs have exacerbated this trend, with cost increases proportionally affecting lowest-income households by a larger degree (see Figure 2.5).

Figure 2.5 Percentile distribution for electricity and gas expenditure as a percentage of income by disposable income quintiles



Source: (Phillips, 2018)

Crucially, energy costs are not affordable for all tenants at all times — causing many to choose between heating and cooling and other essential household costs. Of those Victorian rental properties with children in the home, 40 per cent avoided heating or cooling their home at some point in the last couple of years because they could not afford to do so (Newgate Research, 2018).

2.3 Tenancy impacts of poor thermal control

Thermal control is important for thermal comfort and house amenity. Humans normally run at about 37°C and must expend heat at about the same rate it is produced through normal bodily function. Therefore, most people need a narrow band of temperatures to remain comfortable at home — approximately between 18°C and 24°C. A relatively wider band of temperatures is comfortable and safe if conditions are carefully managed, for instance in more humid climates it is possible to overheat much quicker therefore air-conditioning which reduces humidity can be more important.

Warm homes in winter and cool homes in summer are important for comfort and living conditions. Poor thermal comfort and the inability to control temperature directly results in increased disease prevalence and deaths. Those rental houses which are unable to control temperature or cannot do so affordably are in some cases unsafe for human health.

To a degree, thermal comfort is a substitute for energy savings. Improving energy-efficiency may have no health impacts for households as financial benefits may be realised through lower use of appliances and therefore lower energy bills. Tenants decide for themselves whether thermal comfort or avoided costs is more important. Poor thermal control and therefore energy efficiency limit the decision for tenants.

The ACT sits in two climate zones (as defined in the National Construction Code), Zone 7 “cool temperate” and Zone 8 “alpine”, which means that houses require relatively more investment in thermal control. (Department of Industry, Science, Energy and Resources, 2013). Jervis Bay is Zone 6 “mild temperate”.

A recent study into the effects of indoor heat on public housing tenants in Mildura shows that increased heat had effects on physical health, mental health, social and economic wellbeing (Lander, et al., 2019). Interviews with residents suggested that in many cases during summer it was hotter indoors than outside, however tenants were forced to shelter indoors to avoid direct sun exposure. Effects of high temperatures were many and varied, including:

amenity impacts:

- inability to sleep
- inability to cook (to avoid added temperatures)
- reduced physical activity
- lowered ability to work
- increased reliance on places other than home to keep cool

health impacts:

- heat stroke
- heat exhaustion
- sweating
- dehydration
- headaches
- trouble breathing
- pain and discomfort for pregnant residents
- exacerbation of pre-existing conditions (including mental illnesses and disorders)
- mood changes
- worry
- despair
- depression

social impacts:

- isolation
- decreased family wellbeing
- antisocial behaviours
- increased people roaming the streets at night
- increased crime and vandalism
- increased substance abuse
- increased community violence

Other indirect impacts (or co-benefits) of thermal quality that have been suggested in the literature, but are not yet well-established (IEA, 2015) include:

- lessened family tensions if installation of energy efficiency measures allows more areas of the dwelling to be heated, lessening the need for the family to crowd into a single heated room in winter
- reduced social isolation if energy efficiency measures reduce occupants’ embarrassment with their uncomfortable conditions
- improved social cohesion and sense of community among residents
- higher rates of school attendance
- healthier lifestyles
- improved access to local services.

2.3.1 Health impacts of poor thermal insulation

The World Health Organisation (WHO) recommends indoor temperatures from 18°C and 24°C, stemming from a systematic review of temperature risks to human health, while noting that higher minimums and lower maximums are necessary for vulnerable persons (WHO, 2018). WHO’s recommendations note that health impacts are differentiated between peak (occasional high or low temperatures) and chronic high or low temperatures.

A multinational study by Gasparrini et al. (2015) found that 7.71 per cent of mortality had non-optimum temperature in selected countries as a cause (Australia, Brazil, Canada, China, Italy, Japan, South Korea, Spain, Sweden, Taiwan, Thailand, UK and USA). More temperature-related deaths were caused by cold than by heat — in Australia, 6.5 per cent of mortality has cold as an attributable cause, while only 0.45 per cent had heat as an attributable cause. The effect of days of extreme temperature was found to be substantially less than that attributable to milder but non-optimal weather.

Cold temperatures

Cold indoor temperatures in winter are intimately linked to outdoor temperatures, structural deficiencies — including a lack of thermal control features like insulation and draught sealing — and a lack of heating. Evidence supporting WHO's recommendations on indoor temperatures suggest that cold weather is linked to increased blood pressure, asthma and respiratory illness, and depression; as well as acute illness and hypothermia, which is an immediate risk to life.

A recent study of 217 hypothermic presentations (July 2009 to September 2016) to the Alfred Hospital and Sandringham Hospital emergency departments, in Victoria, showed that 78 per cent of these occurred indoors. Most of these cases were amongst older individuals, with three quarters older than 55 years old. Of these cases of hypothermia, 16 per cent died as a result (Forcey, FitzGerald, Burggraf, Nagalingam, & Ananda-Rajah, 2019).

Better Renting (2019) estimated that annual cold-related deaths related to housing could be up to 42 people in the ACT in 2019. This is estimated by apportioning 30 per cent of the excess deaths in Canberra's colder months based on international research, including Gasparrini et al. (2015).

Alleviation of chronic thermal discomfort can also contribute to improved mental wellbeing (IEA, 2015).

Hot temperatures

As with minimum cold temperatures, WHO provides recommended maximum temperatures for indoors. High indoor temperatures are related to outdoor temperatures, housing materials and orientation, green spaces, and thermal control features like insulation, controlled ventilation, shading and access to cooling or air conditioning. The importance of moderate indoor temperatures may be more important to allow people to escape high outdoor temperatures.

However, unlike cold temperatures, safe maximum indoor temperatures are location dependant and vary significantly — acclimatisation matters. In typically cool regions, such as Boston, maximum temperatures as low as 25°C are considered acceptable. While in hot regions, such as Thailand, maximum temperatures above 30°C are considered acceptable. As with cold temperatures, vulnerable persons have less capacity to deal with high indoor temperatures.

High indoor temperatures are associated with increased blood pressure, respiratory and cardiovascular disease, mental health, pregnancy outcomes, and sleep quality, as well as acute heatstroke which is an immediate risk to life.

The magnitude of the problem

Some indication of the magnitude of the problem can be found in the literature:

- Energy efficiency can help reduce mortality rates related to homes that are too cold or too hot.
  - Homes that are too cold or too hot, particularly during hot and cold weather spells, can lead to an increase in mortality. Gasparrini et al. (2015) found that cold weather

contributes towards 6.5 per cent of all deaths in Australia and hot weather contributes towards a further 0.5 per cent of deaths. Furthermore, a recent study found that the mortality rate from events similar to the 2009 Melbourne heatwave might be reduced by 90 per cent if all houses with lower energy star ratings are upgraded to a minimum 5.4 star energy rating (Alam, Sanjayan, Zou, Stewart, & Wilson, 2016).

- Energy efficiency can reduce respiratory diseases and the impact of allergies
  - Excess cold and indoor humidity or dampness can generate and aggravate a range of illnesses, including allergies and respiratory diseases such as asthma. In addition, excess dampness can lead to mould growth, which has further negative health impacts (ACIL Allen, 2017).
  - National and international literature suggest that:
    - Household mould and moisture can contribute to asthma, wheezing and allergic rhinitis in both adults (Juel Holst, et al., 2020) and children (Tischer, Chen, & Heinrich, 2011).
    - Exposure of Australian children to damp housing is associated with 7.9 per cent of the total asthma burden in children aged 14 years or under (Knibbs, Woldeyohannes, Marks, & Cowie, 2018).
    - Europeans living in damp or mouldy homes are reported to be 40 per cent more likely to have asthma (Velux, 2021) and that 21 per cent of the asthma cases reported in the USA are attributable to dampness and mould exposure in the home (Mudarri & Fisk, 2007).
    - New Zealand people living in insulated houses are found to have about half the odds of reporting respiratory symptoms as those living in uninsulated houses, and also have reduced odds of reporting colds or flu. Children living in these houses also have lower odds of reporting asthma symptoms and of missing school due to illness (Howden-Chapman, et al., 2007).

Impact on public health spending

Poor energy efficient homes affect not only Australians' health, but they also have an impact on the economy overall through increases in public health spending.

The economic impact of respiratory diseases associated with poor energy efficient homes is significant.

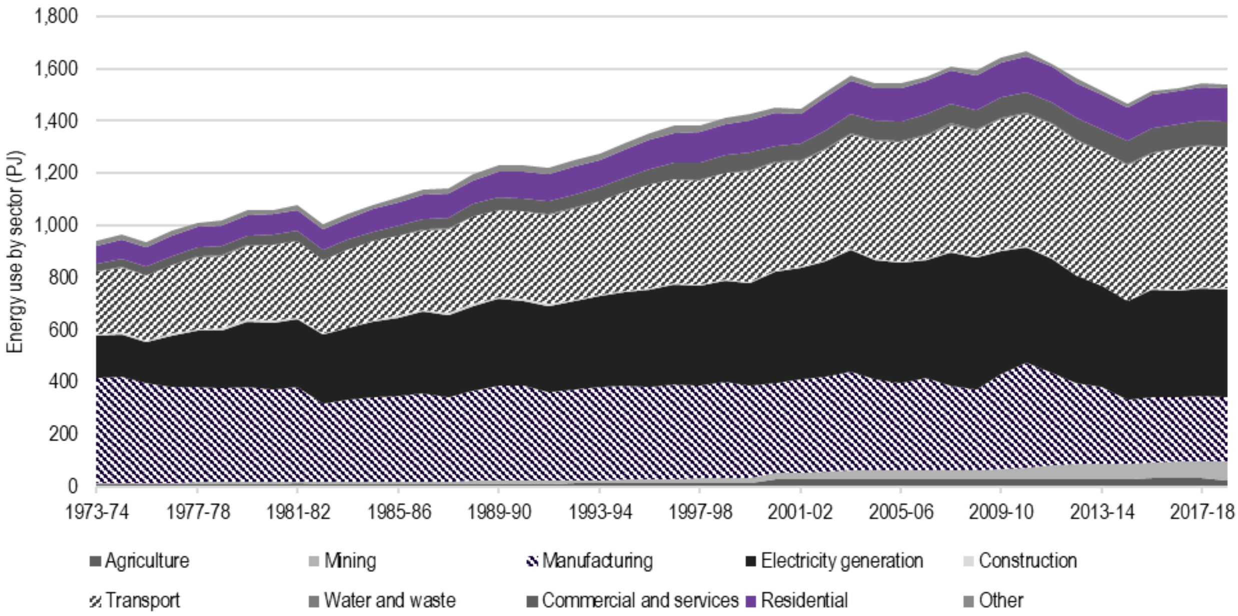
The cost of asthma to the Australian community in 2015 was $28 billion, or around $11,740 per person with asthma. Around $1.2 billion of this were direct costs to the health system, including medication, hospital and out-of-hospital costs. Another $2 billion were productivity costs, other financial costs (such as the costs of respite for informal carers, costs of formal care, special equipment, travel and accommodation costs to access health services, the cost of other government programs, asthma research, and funeral costs) and deadweight losses (the cost of inefficiencies and distortions in the economy as a result of asthma's negative impacts). The biggest component of the cost of asthma was the burden of disease, calculated as $24.7 billion (which includes the effect of disability and premature death) (Deloitte Access Economics, 2015).

The cost of Chronic Obstructive Pulmonary Disease (COPD) to the Australian economy in 2008 was $98.2 billion. Of this, $6.8 billion were productivity losses due to lower employment, absenteeism and premature death of Australians with COPD, $0.9 billion were direct costs to the health system, $0.3 billion were other indirect costs such as aids and home modifications and the bring-forward of funeral costs and $0.9 billion were the deadweight losses from transfers including welfare payments and taxation forgone. The biggest component of the cost of COPD was the burden of disease, calculated as $89.4 billion (which includes the effect of disability and premature death) (Access Economics, 2008).

2.4 Environmental impacts of poor thermal control

While the benefits of temperature control is clear for households, poor thermal control results in higher energy costs to achieve comfortable, healthy and safe homes. The residential building sector is a major source of energy demand and use. It accounts for approximately 8.3 per cent of New South Wales and the ACT's combined energy use (see Figure 2.6).[2] In 2018-19, this was 127.6 petajoules (PJ), five times larger than the agricultural sector. Since 1974, residential energy use has increased by an average rate of 1.4 per cent per year. This represents an 82.1 per cent increase in residential sector energy consumption over the period 1974 to 2019.

Figure 2.6 New South Wales and Australian Capital Territory energy use, by sector, 1973-74 to 2018-19



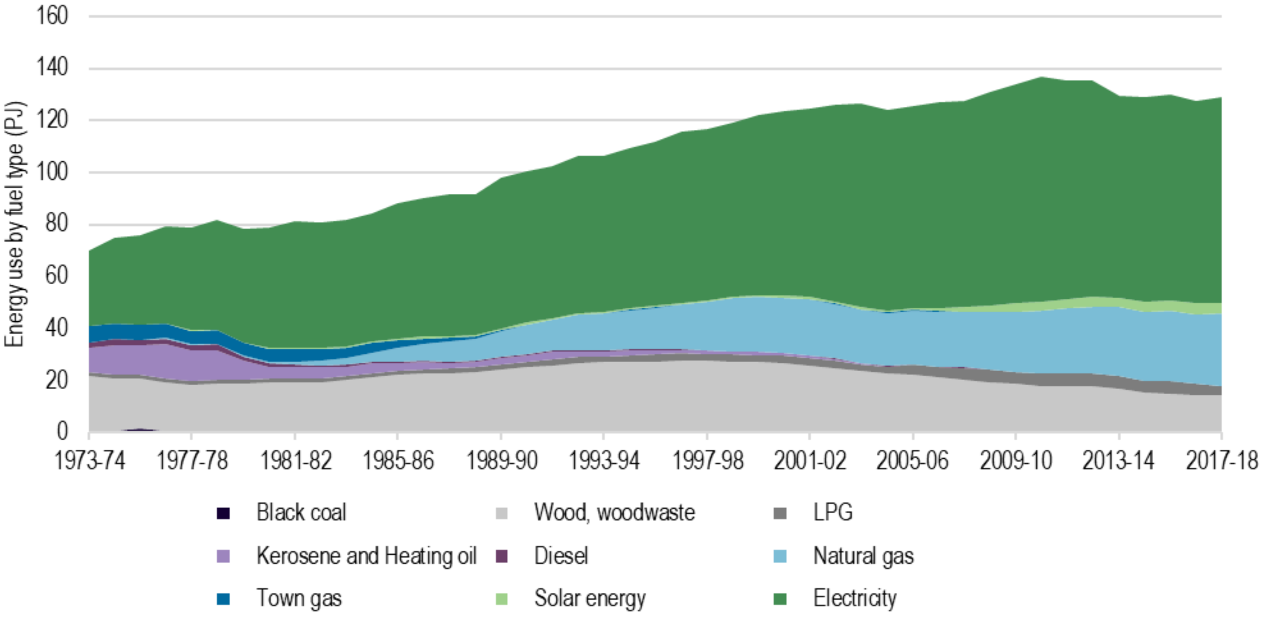
Source: (DISER, 2020)

Even as the ACT has moved to 100 per cent renewable electricity, residential energy use is still drawn heavily from the burning of fossil fuels or firewood. In some years, more than a third of residential energy use comes directly from on-site burning of fossil fuels — such as natural gas, LPG — and wood products — for space heating, cooking and water heating. The proportion of these direct burning fossil fuels has decreased over time (see Figure 2.7), as has the proportion of fossil fuels used in the electricity grid over time.

It is difficult to know the exact greenhouse gas emissions from the residential sector, especially given the variety of ways that energy is used at the household level. The COAG Energy Council estimates that the Australian residential building sector is responsible for around 11 per cent of Australia's emissions (COAG Energy Council, 2020).

[2] Energy use for New South Wales and the Australian Capital Territory is combined in the source data, and it is not possible to disaggregate the ACT's contribution alone.

Figure 2.7 New South Wales and Australian Capital Territory residential energy use, by fuel type, 1973-74 to 2018-19



Source: (DISER, 2020)

2.5 Conclusion

Rented premises are an important and growing part of Canberra's housing market. Tenants now make up almost one-in-three households in Canberra — with 40,559 in private rental properties.

Thermal control features are necessary to make houses safe and comfortable for inhabitants. These features, such as insulation or draught sealing, protect inhabitants in both hot and cold weather. Evidence on the energy-efficiency of rental properties shows that many tenants live in lower energy-efficient properties with poor thermal control. Further, the burden of insufficient thermal control falls disproportionately on tenants from low-income households, concession card holders, those with a disability, aged tenants, and households with children.

Poor thermal control has economic, social, amenity and health impacts on tenants. Rising housing costs paired with rising energy costs put stress on household budgets, particularly for low-income houses. In 2018, of the lowest-income quintile, half paid somewhere between 3.4 per cent and 8.8 per cent of disposable income on energy costs. In a Victorian study, around 40 per cent of rental households avoided heating or cooling in the last few years because of the cost of heating.

The reported social, health and wellbeing impacts of poor thermal control in unsafe houses are also significant. Social and wellbeing impacts of uncomfortable or unsafe temperatures include inability to sleep, inability to work or attend schooling, antisocial behaviours, crime and violence. Health impacts of both prolonged and acute extreme temperatures include mental illness, respiratory illnesses, cardio-vascular illnesses, and in some extreme cases death.

The need for government intervention 3

This chapter explores the policy rationale and the case for government action to prescribe minimum standards for rental properties. Features-based and performance-based measures are collectively referred to as thermal control features in this chapter.

3.1 Market failures

In a market-oriented economy such as the ACT's, government intervention through regulation and other means is usually predicated on the existence of market failures that prevent optimal outcomes from being achieved. The types of market failure that may justify government intervention include split incentives, information asymmetry, externalities and imperfect information.

Market failures by themselves are insufficient to warrant government intervention. Intervention may be justified when the benefits of intervention outweigh its costs (including administrative and compliance costs), and in other cases, governments may regulate to achieve public and social good outcomes, such as equity and human rights.

3.2 Split incentives in the context of thermal comfort for rental households

Split incentives are often cited as the most significant barrier to improving the thermal control for rental properties. They arise when the costs and benefits of a transaction, that could otherwise have an overall payoff, are split between parties so that the transaction does not take place. In the context of this RIS, it refers to a decision to improve thermal control features which is normally made by the rental provider and in some cases the owners' corporation, but where the beneficiary of this decision is primarily the tenant.

While rental providers are responsible for supplying and maintaining features which impact on the thermal control of properties, tenants are liable for day-to-day running costs, including those of gas and electricity. As rental providers do not receive any of the direct saving benefits arising from improving thermal control and comfort, they are likely to try to keep down initial costs rather than to install or invest in thermal control features for rental properties.

On the other hand, tenants face a different set of barriers to improving thermal control. These include the lack of legal rights to install fixed features to improve energy efficiency in rental accommodation, the length and certainty of tenure in a particular property, and the lack of tax incentives to make improvements.

ACIL Allen surveyed tenants on their views of a minimum standard. While close to a half had asked for some energy efficiency improvement — 90 per cent of these requests were declined, for a range of reasons. Further, organisations which represent tenants suggested that often tenants choose not to ask for improvements to rental properties because they do not want to be viewed as difficult tenants or for fear of retaliation from rental providers (see Appendix F).

These barriers may be particularly acute for low-income tenants, who have a limited number of properties available in the private rental market that are affordable to them (Phillips, 2018). Tenants, including non-low-income tenants, have reported being reluctant to ask for energy efficiency improvements if this could lead to non-lease renewal or eviction (Newgate Research, 2018).

The Newgate survey for the Victorian Government (2018) found that only 1 per cent of tenants and 28 per cent of rental providers are willing to pay for ceiling insulation. Rental providers with a house, rather than a flat, apartment or a townhouse, were more willing to pay for ceiling insulation (50 per cent compared to 19 per cent). Tenants were unwilling to pay for anything with a large outlay in price, especially if they could not take it with them to another property.

The proportion of tenants and rental providers willing to pay for draught proofing was higher — 16 per cent of tenants and 49 per cent of rental providers. Of a number of energy efficiency features tested during the survey, draught proofing had the lowest initial outlay, lowest installation costs and quickest return on investment. However, draught proofing was not appealing to tenants if they were not intending to be in the property for some time.

In a market where split incentives exist, there are suboptimal outcomes to society. In the case of lack of investment in ceiling insulation and draught proofing, this means that even though these investments would have an economic payoff, they are not exploited because the rental providers cannot recover the costs of their investment if there is no mechanism for them to do this (for example, through higher rents).

3.3 Interaction of split incentives and information asymmetry

Rental providers are often unable to recover the costs of the improvements in the form of higher rents because of a second market failure — the information asymmetry between rental providers and tenants concerning energy efficiency and thermal control features. The effect is more apparent in tight rental markets (Murray-Leach, 2019).

In essence, tenants are unable to distinguish properties with high energy efficiency from those with low energy efficiency because virtually no rental providers voluntarily have their buildings rated under schemes such as the Victorian Residential Scorecard and make the information public.

Better Renting (2019) looked at advertisements for almost 20,000 rental properties. Of these, two-in-five listed Energy Efficiency Ratings (EERs) of 0. While this partially supports the fact that rental properties perform worse than owner-occupier properties, representatives of the real estate industry acknowledged that human-error is also partly to blame. Despite the compulsory nature of EER listings in the ACT, some properties listed with an EER of 0 would be done so because of a listing error or because a rating is not readily known. Whatever the cause, it can be difficult for potential tenants to understand the energy-efficiency of prospective properties.

In normal residential rental market conditions, not many potential tenants have the bargaining power to demand verifiable information on the energy efficiency performance of properties they are considering, in part because rental providers know that potential tenants take into consideration (and often value more highly) many attributes besides thermal control in their rental decisions.

The Newgate survey for the Victorian Government (2018) found that the strongest drivers of perceptions about rental properties among tenants were the general condition of the property, value for money, and performance and presence of fixed appliances. The cost of energy bills and the ease of maintaining a comfortable temperature had a relatively low impact on tenants' ratings of their rental property as a place to live. This limits choice and leverage for tenants in negotiating features, and also limits incentives for rental providers and property managers to focus on and improve energy efficiency in rental properties.

Similarly, a 2012 study by ACIL Tasman for the then Department of Climate Change and Energy Efficiency found that the majority of real estate agents, Real Estate Institutes and tenancy unions interviewed for the study believed that energy consumption is far less important a factor in rental decisions than the location of a property and other attributes. This means that rental providers are less likely to incur the cost and hassle of energy efficiency upgrades if they believe that such upgrades are not likely to sway the decisions of potential tenants, who are more willing to pay higher rent for proximity to public transport and good schools (for example) than greater energy efficiency.

Rental providers are primarily motivated by direct financial incentives in relation to the uptake of thermal control features at their properties. Though they may encourage tenants to stay for longer periods, energy savings on behalf of tenants may not translate into pecuniary benefits for rental providers through higher rents for many properties.

It should be noted that addressing the information problem might be of less value to low-income tenants than other tenants, even if they value energy efficiency highly. This is because low-income tenants typically have fewer choices about their accommodation than other tenants.

3.4 Other barriers

In addition to split incentives and information asymmetry, other market failures and barriers also impede the adoption of thermal control upgrades in rental households in Canberra. These market failures include adverse selection and capital market imperfections, while other barriers include behavioural failures and the impact of uncertainty on decision-making by rental providers.

These other barriers:

— **Lead to split incentives** — Inadequate or asymmetric information, and externalities, lead to a situation where there is no increase in rents for an increase in energy performance. This is because the market is unaware of the value, or that some portion of the value (the externality) is not captured. This is the fundamental cause of split incentives (that is, the costs of an installation cannot be recouped through higher rents).

— **Compound the effect of split incentives** — Capital constraints, transaction costs and bounded rationality reinforce and amplify the effects of split incentives, in leading to lower uptake than would otherwise be optimal.

3.4.1 Adverse selection

The information asymmetry problem discussed above can lead to 'adverse selection'. Adverse selection occurs when a buyer is not able to differentiate between high quality and low-quality goods in the market at the time of purchase, and perhaps also not until a significant period of time after purchase. In the presence of this uncertainty, high quality products can be driven out of the market.

The best-known example of adverse selection relates to the used car market, where used car buyers know that they have a risk of purchasing a poor-quality vehicle but have no reasonable means of identifying it from the higher quality cars until they have driven the car for several months after purchase (in the absence of any other third-party assistance). To account for this risk, used car buyers will offer a price that is below what the seller of a high-quality vehicle would be willing to accept. This theoretically drives higher quality cars out of the market, if there is an unlimited supply of used cars.

Adverse selection is most common for those products where it is difficult for consumers to ascertain quality at the time of purchase (and even for some period after purchase), and where they do not have sufficient prior experience on which to base their decision. There are a number of characteristics of residential building energy efficiency that increase the risk of adverse selection in the rental market, for example, almost one-in-three (29 per cent) tenants do not know whether ceiling insulation is installed. Similarly, about one-in-four (26 per cent) of rental providers do not know whether their rental properties have ceiling insulation.

In markets where there are information asymmetries, adverse selection can drive down the amount of thermal control or energy efficiency 'premium' achievable — essentially making it more challenging to achieve higher rents or a higher price to reflect the investment made in energy efficiency performance. This can occur where potential tenants are unable to differentiate on energy efficiency grounds — that is, where information on thermal control features is not provided or not available for tenants.

Where adverse selection occurs, there is a greater risk to the return on investment from energy efficiency improvements. Therefore, even if a rental provider had an opportunity to invest in ceiling insulation but had limited ability to signal the quality of this property over and above others in the market, the investment is less likely to take place. Performance ratings and real estate agents' advertisements are two common methods for rental providers to signal the higher quality of their property, reducing the risk of adverse selection in the rental property market.

3.4.2 Inadequate information

Rental providers may be reluctant to install ceiling insulation or draught proof their properties if they do not understand all of the benefits, or if the benefits are not immediately apparent (such as improved ability for tenants to stay current on rent payments and reduced vacancy).

In some cases, rental providers do not have sufficient information to determine the most appropriate actions to take without seeking expert technical advice. In the survey of ACT rental providers undertaken as part of the development of this RIS, 5.59 per cent of rental providers said they had not invested in improving the energy efficiency of their rental properties because they did not have the information necessary. Though others responded for other reasons, it is possible that information contributed as a limiting factor.

3.4.3 Capital market imperfections

In addition to the split incentive and asymmetric information problems, rental providers and tenants may also face capital market imperfections in financing investments in thermal comfort features. In particular, less well-resourced rental providers and tenants without a strong financial track record may experience difficulties accessing loans from the financial markets to invest in improving thermal comfort even where that investment has a high rate of return. This will be a barrier to the uptake of thermal comfort upgrades by rental providers, even though the tax system may allow them to depreciate such assets.

3.4.4 Externalities

The benefits of thermal comfort features are likely to spread beyond tenants and rental providers to society more broadly. Other benefits include a reduction in greenhouse gas (GHG) emissions (see section 2.4) associated with lower energy use, avoided health system costs (which are passed on to all taxpayers), lower costs of energy supply (by reducing peak demand) and lower costs to energy retailers (by improving bad debts). These benefits are examples of externalities, where a third party not involved in the transaction benefits (or is made worse off) from that transaction.

3.4.5 Transaction costs

The cost of installing a thermal comfort feature goes beyond the simple upfront cost of the device. Rental providers incur a financial and time expense in facilitating the installation. Some rental providers are time-poor and the cost of their time could be just as strong or greater barrier to uptake.

3.4.6 Behavioural failures

Over time, increasing attention has been given to the role of "behavioural failures" as impediments to the take-up of thermal control features that would yield private benefits in excess of private costs.

More than 25 sources of "behavioural failure" have been identified in the behavioural economics literature. Key sources, some of which overlap, include[3]:

— *computational issues* (limited attention, decisional conflicts, over-optimism and over-confidence, self-serving bias, limited analytical capacity including bounded rationality and rule of thumb (heuristic) decision-making)

— *self-control issues* (time inconsistency, procrastination, temptation, channelling and framing)

— *preference issues* (reference-dependent preferences including endowment effects, status quo bias and loss aversion, outward looking or other-regarding preferences including altruism, fairness concepts and social norms).

Bounded rationality is the idea that in decision-making, the rationality of individuals is limited by the information they have, the cognitive limitations of their minds, and the finite amount of time they have to make a decision. This could potentially be a reason why renters and tenants do not undertake discounted cash flow calculations, preferring to fall back on rules of thumb, before deciding on a thermal control investment or whether a more energy efficient property justifies a higher rental cost.

Loss aversion (the tendency for people to strongly prefer avoiding losses than acquiring gains) could be why the up-front costs of investments appear to be given more weight than cost savings over the life of the investment. Framing through advertising could help explain why buyers give less attention to thermal control than other features of rental accommodation.

3.4.7 Impact of uncertainty on decision-making

The apparent under-valuation of thermal comfort features in rental accommodation might also reflect the (real option) value rental providers place on deferring thermal control investments to maintain flexibility or wait for more information in the context of:

— a significant degree of irreversibility of capital costs because of uncertainty regarding capitalisation of future cost savings on resale

— uncertainty faced by tenants at the time of lease signing regarding future cost savings and other benefits that may be realisable

— imprecise expectations of ongoing improvements in technologies for improving thermal comfort.

It is rational for tenants and rental providers to allow for these considerations when making decisions regarding transactions.

3.4.8 Importance of split incentives relative to other barriers

As noted previously, energy efficiency performance does not necessarily influence rents in the long term. This lack of rental premium means that, even if other barriers are overcome (hypothetically if

[3] For simple summaries of these potential sources of behavioural failure, see Thaler, Sunstein (2009), ch. 1 and Congdon et al (2011), ch.2. For discussions in the context of the environment and energy efficiency, see Shogren, Taylor (2008); Brekke, Johansson-Stenman (2008); Gillingham, Newell, Palmer (2009); Tietenberg (2009).

there was complete information, sufficient capital available to rental providers and negotiating power for low-income tenants came close to or on par with higher income segments), split incentives would still inhibit investment. As a result, other drivers (for example, rising energy prices and compensation for greenhouse reduction activities through government policies and initiatives such as the ACT's Energy Efficiency Improvement Scheme (EEIS) program) have little to no effect to-date.

For example, the Household Power Savings Program (HPSP) in New South Wales needed consent from rental providers to install free energy-saving kit items. These items would have reduced tenants' energy consumption at little or no cost to the rental providers. While there was no capital required and parties were informed of the benefits, rental providers did not provide this consent in 94 per cent of cases (NSW Government, 2015). While this poor uptake could be caused by poor communications or some other factor, it illustrates that the outcome can, and does, get affected by having additional parties with their own incentives and objectives.

If split incentives were hypothetically resolved (that is, if a rental premium could be earned for improving thermal comfort), other drivers and initiatives would likely start to have more of an effect. In cases where these drivers are strong enough to outweigh barriers (or if the barriers could be lessened by, for example, providing information or financing), uptake of thermal comfort features would probably increase.

Using this 'counterfactual' approach (where removing all barriers except the split incentive problem would have little impact on improving the thermal comfort for rental households whereas removing the split incentive problem would enable drivers or initiatives to have more positive impacts), we conclude that split incentives appear to be the largest factor in inhibiting investment in thermal comfort features in the private rental market.

3.4.9 Public and community housing

The split incentives in public and community housing take on a somewhat different form. While public and community housing providers would, on face value, be motivated by benefits to tenants (by improving thermal comfort, improving health and wellbeing, reducing bill pressures and reliance on welfare, and increasing financial inclusion), some of their institutional arrangements and policies nullify this natural incentive for the uptake of thermal comfort features.

In public housing, the provider is regulated as a commercial entity and therefore split incentives has a similar effect to that in the private rental market. Likewise, community housing providers in New South Wales consulted by ACIL Allen in 2015 reported that there was no link between the energy efficiency of properties and the funding they receive (mirroring the situation in the private rental market where there is a limited link between energy performance and financial return).

In addition to split incentives, there are also some unique barriers in public and community housing. For example:

- energy retailers reported difficulties gaining access to public housing in some instances when trying to assist customers with appliance replacements
- for some community housing, policies are in place that specify types of fixtures approved for installation and some energy-efficient fixtures may not be on this approved list
- there is more of an imperative to increase supply of housing to meet unmet demand (with some applicants waiting two to three years) as a priority over energy efficiency or thermal comfort; therefore, energy efficiency or thermal comfort (or other quality issues) become much more of a secondary concern.

Governments have tried to address the lower uptake by making direct investments into public and community housing assets (for example, the ACT Government has recently invested an additional

$8.9 million into general property and energy-efficiency upgrades, including new reverse-cycle heating and cooling).

Furthermore, community housing providers reported that they are starting to own some of their assets and therefore starting to face stronger incentives to improve energy performance (and reduce lifecycle costs).

While public and community housing is less affected by split incentives (particularly community housing where there is evidence of stronger uptake), lower uptake of energy saving fixtures has also arisen due to the unique barriers described above.

However, given that the beneficiary of investment in public or community housing is also ultimately the owner of the asset, these barriers can and have been overcome in this segment (through, for example, programs targeting direct investment in those assets).

In summary, split incentives exist but are not the only, nor necessarily the overriding, driver of lower uptake in this segment.

3.4.10 Multi-unit dwellings

In the 2016 Census, Canberra rental households mostly rented houses (either stand-alone or semi-detached) with 32 per cent renting in multi-unit properties (flats, units or apartments) (ABS, 2018). Since this time, the proportion of multi-unit properties have continued to increase relative to the total housing stock. In the case of multi-unit dwellings, split incentives are strong but so are other barriers (technical and economic feasibility, transaction costs and sophistication required to assess business cases) – therefore split incentives only partly explain lower uptake of energy efficiency and thermal comfort improvements.

For example, it may not be possible in some multi-unit dwellings to install ceiling insulation. Resolving the incentives for these improvements therefore may not increase their uptake significantly.

Strata arrangements in multi-unit dwellings also create additional challenges for the uptake of thermal control features, including that:

- an additional decision maker (the owners corporation) must also approve the installation through a special resolution (and a significant majority of member's votes) for most features and therefore the incentives and costs are split amongst an even greater number of decision makers
- new by-laws often need to be drafted alongside the installation of a thermal control feature, which adds to transaction costs
- the owners corporation does not have an incentive to invest in features unless this can reduce outgoings for common areas (and therefore ultimately strata levies)
- the owners corporation often does not have the level of sophistication and know-how to evaluate proposals for such upgrades.

3.4.11 Property managers

While addressing split incentives is vital, that is not to say other barriers in the private market should be ignored. An important point raised by stakeholders consulted was the role of property managers. The majority of private rentals are managed through a real estate agency (by a property manager). In many cases where fixtures need replacing, property managers tend to only seek approval from rental providers to replace the fixture with the same model as this is a much easier conversation to have than recommending a more efficient fixture (bearing in mind that in some instances strata by-laws may also restrict a more energy-efficient solution).

3.5 Summarising the case for government action

ACIL Allen’s research reveals that split incentives, particularly when combined with other market failures and barriers, inhibit the uptake of otherwise economic features for rental households in the ACT. There is strong evidence of a lower uptake of thermal control features and that split incentives are a key contributor to this outcome. This provides a case for government action justified on grounds of market failure.

The evidence examined in this chapter suggests that appropriate government policies and regulations could lead to:

— improved comfort levels and health outcomes for tenants
— lower health system expenditures for government (and ultimately taxpayers)
— increased asset values for rental providers (as there might be a green premium at time of sale, even if a green rental premium cannot be obtained, because the property could be sold to an owner-occupier rather than an investor)
— potentially lower energy costs for Canberra rental households
— potentially lower bad debts for energy retailers from low-income rental households, which would also benefit their remaining customer base
— potentially reduced need for costly investment in peak load capacity by electricity generators and network service providers
— potentially lower cost of ACT’s renewable energy offsets and improve greenhouse gas performance across ACT’s economy.

Policy options 4

This chapter considers the policy options for improving the thermal control and energy-efficiency of rental properties. It considers the broad range of options available to governments in section 4.1, including what actions have already been taken. It considers what form of government intervention is best for rental properties in section 4.2. Finally, it presents the options considered in detail in section 4.3.

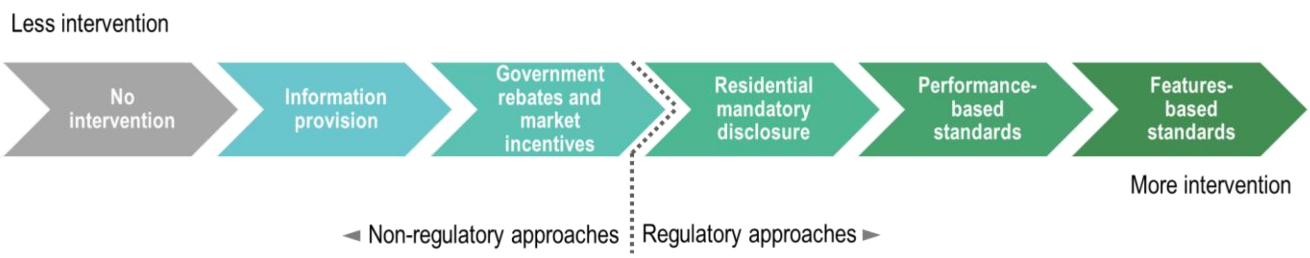
4.1 Spectrum of potential government actions

Government action to improve the thermal control and energy-efficiency of rental households can take a range of forms, from the provision of information to prescriptive feature-based standards (see Figure 4.1). These options are either:

— regulatory options, which enforce action and place controls over private property, and

— non-regulatory approaches, which are tools and services to help residents and owners to make improvements.

Figure 4.1 Spectrum of potential government action



Source: ACIL Allen

4.1.1 Existing policy

The ACT has been a long-time leader in driving improvements in the thermal control and energy-efficiency of properties — both of owner-occupied and rental providers. It has implemented a wide range of non-regulatory and regulatory measures. Existing measures and initiatives include:

— ACTsmart Sustainable Home Advice program – a free program which provides assessments and advice to improve the energy-efficiency of properties.

— Household Sustainability Webinars – to provide generalised advice and information in support of the Sustainable Home Advice Program.

— Renters' Home Energy Assessment – a free program which provides online or in-person assessments tailored to renters.

- The Energy Efficiency Improvement Scheme (EEIS) – a program delivered through energy providers to provide energy savings in households and small-to-medium businesses through subsidies and rebates.
- Sustainable Household Scheme zero-interest loans – loans of up to $15,000 for households to invest in solar, battery storage, energy-efficient electric appliances or electric vehicles.
- Mandatory energy efficiency rating disclosure provisions for property sales and, where they exist, for rental properties.
- The Low Income Household Program – assessments and advice tailored for low-income households.
- The Solar for Low Income Program – which provides an additional subsidy of up to 50 per cent of the costs of solar systems for low-income families.
- The Next Gen Battery Storage Program – which provides subsidies for the installation of a battery installation to support solar systems.
- The Wood Heater Replacement Program – which provides rebates for properties to replace or decommission wood heaters.

4.2 How best can government intervene?

As illustrated in Figure 4.1, there a number of potential solutions to address poor thermal control and energy efficiency in rental properties in the ACT, including:

- information provision
- government rebates and market incentives
- regulation of information provision
- regulating performance standards
- regulating features standards.

Each of these solutions will improve thermal comfort and energy efficiency in some sections of the community. However, each of these solutions is not necessarily appropriate for rental households in terms of the efficiency and effectiveness of those solutions — especially in the context of the market segment under consideration and the split incentive problem. For example, educating tenants or rental providers on the benefits of installing thermal control features in rental properties will only be effective where the tenant or rental providers has the ability to absorb that information and take action. While providing incentives and grants will reduce the capital cost associated with installing thermal control features, it does not overcome the split incentive problem.

ACIL Allen recently developed a strategic framework for Energy Consumers Australia to support households to manage their energy bills, including by choosing to improve the building fabric and fixed appliances, and choosing more energy efficient equipment and appliances. This framework can be applied to identify the most appropriate solutions to address the energy efficiency barriers that have been identified.

The strategic framework comprises three elements, as illustrated in Figure 4.2:

- the range of choices available to households to manage their energy bills
- the different types of Australian households and their diverse motivations, abilities and opportunities to manage their energy bills
- the range of tools and services that could support different types of Australian households to make different choices to manage their energy bills.

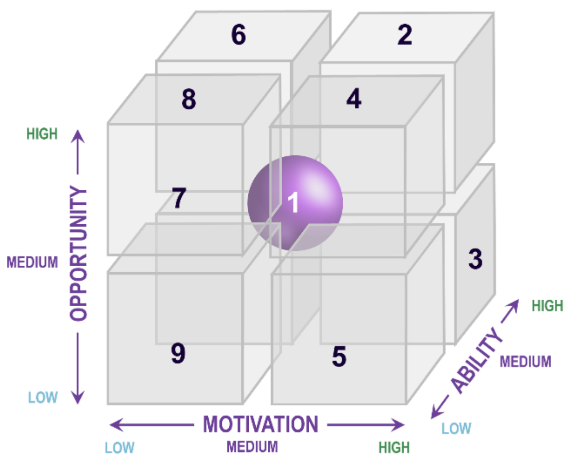
Figure 4.2 Elements of the strategic framework to support households to improve thermal control and manage energy use

Source: ACIL Allen

4.2.1 Different types of Australian households

The strategic framework categorised households based on three dimensions — their motivation, ability and opportunity to manage their energy bills — to identify nine different types of Australian households, as illustrated in Figure 4.3.

Figure 4.3 Different types of Australian households



TYPE OF HOUSEHOLD	MOTIVATION	ABILITY	OPPORTUNITY
Enthusiasts	HIGH-MEDIUM	HIGH-MEDIUM	HIGH-MEDIUM
Completers	HIGH-MEDIUM	HIGH-MEDIUM	LOW-MEDIUM
Dependent	HIGH-MEDIUM	LOW-MEDIUM	HIGH-MEDIUM
Stuck	HIGH-MEDIUM	LOW-MEDIUM	LOW-MEDIUM
Middle Australia	MEDIUM	MEDIUM	MEDIUM
Complacent	LOW-MEDIUM	HIGH-MEDIUM	HIGH-MEDIUM
Competent	LOW-MEDIUM	HIGH-MEDIUM	LOW-MEDIUM
Cautious	LOW-MEDIUM	LOW-MEDIUM	HIGH-MEDIUM
Hard to help	LOW-MEDIUM	LOW-MEDIUM	LOW-MEDIUM

HIGH-MEDIUM MEDIUM LOW-MEDIUM

Note: 1 = Middle Australia; 2 = Enthusiasts; 3 = Completers; 4 = Dependent; 5 = Stuck; 6 = Complacent; 7 = Competent; 8 = Cautious; 9 = Hard to help
Source: ACIL Allen

The factors that influence a households' motivation, ability and opportunity to manage their energy bills are summarised in Table 4.1. The factors that are relevant vary by the type of choice that can be made. For example, whether a household lives in rental accommodation is relevant to improving the building fabric by installing ceiling insulation but not to choosing an energy deal from their energy retailer.

Table 4.1 Summary of factors that influence a household's motivation, ability and opportunity

Motivation	Ability	Opportunity
– Attitude towards the behaviour, for example, the perceived costs and benefits, the importance of energy, and cultural considerations – Alignment with choices made within the household's circle of influence – Likelihood of success – Unwillingness to create disharmony/conflict	– Ability to self-advocate, negotiate – Belief in the ability to succeed – Trust in others – Ability to influence behaviour of all household members – General interest in, and capability using, technology – Literacy, numeracy, problem solving and research skills – Language barriers	– Type of housing – Home ownership status – Scope to manage the energy bill – for example, to improve the building fabric or to install more energy-efficient appliances – Access to liquid funds

Source: ACIL Allen

The factors that influence a particular household's motivation and opportunity to control their thermal comfort and invest in energy efficiency will also vary depending on the choice that is to be made. For example, a particular household may have the opportunity to choose more energy-efficient equipment but may not have the opportunity to choose to improve the building fabric of their home because they are a tenant.

There is no set proportion of people in each segment, the size of each segment is dynamic — it will vary depending on the choice being made by the household and will also vary over time.

For instance, a household may have the opportunity to choose more energy-efficient appliances but may not have the opportunity to choose alternative energy sources because they rent their home. The household will be in one segment for choices relating to choosing energy efficient appliances and another segment for choices relating to alternative energy sources.

The factors that influence a household's motivation and opportunity to manage their energy bills will also vary over time. For example, a household may not have the opportunity to choose to improve the building fabric of their home in the short term because they are a tenant but will have the opportunity if they purchase their own home.

Tenants generally have a low opportunity to make substantial changes to the building structure and fittings because of the split incentive barrier discussed in Chapter 2. Accordingly, they have low motivation to make up-front investments in energy-efficiency as the perceived costs and effort exceed the perceived benefits, particularly if their tenure is relatively short or uncertain. Tenants are therefore generally categorised as Competent or Hard to Help in the consumer segmentation framework.

Rental providers have low motivation to install ceiling insulation and to draught proof because of the split incentive barrier — the perceived costs are high relative to the benefits. Rental providers are therefore generally categorised as Complacent, Competent, Cautious or Hard to Help in the consumer segmentation framework.

4.2.2 Non-regulatory approaches and tools to help improve the thermal control of rental premises

There is a range of non-regulatory tools and services that can help tenants and rental providers to manage the thermal control and energy-efficiency of their properties without relying on regulation. These tools help decision making or lower barriers to action. These can be categorised broadly as:

— information, advice and non-financial support

— incentives

— financial support

— support services.

Broad examples of the types of initiatives in each of these categories are illustrated in Figure 4.4. As noted in section 4.1.1, the ACT Government is already providing many of these tools and services.

Figure 4.4 Tools and services to help households improve thermal control and manage energy bills

INFORMATION, ADVICE AND NON-FINANCIAL SUPPORT	INCENTIVES	FINANCIAL SUPPORT	SUPPORT SERVICES
– Awareness campaigns – Word of mouth communication, role models, or exemplars – General, tailored, or personalised information – Market-based tools and services	– Feedback on an outcome – general, specific and timely – Incentivise desired, or penalise undesired choices – Market structuring	– EEIS financial support, other grants and subsidies – Loans – Government investment in public housing upgrades – Funding for community organisations to provide services	– Access to community support services that can assist households – Access to government resources and knowledge

Source: ACIL Allen

Initiatives that are the most appropriate for the different types of households

This section considers which of the types of initiatives illustrated in Figure 4.4 would be appropriate to address the barriers to investment in thermal control for rental premises.

Information, advice and non-financial support

The types of information, advice and non-financial support that can be provided are:

— educate users on energy consumption and the benefits of improved thermal control

— promote thermal control disclosure

— support development of a national consistent rating scheme for existing homes.

This can be provided in the form of general information or advice (i.e. more specific information).

General information

General information initiatives include awareness campaigns and the provision of general information.

Information can be used to engage with households to increase their level of motivation to make a choice. That is, to move them from a low or medium level of motivation to a high level of motivation.

Awareness campaigns are generally a low cost means of communicating a simple message to a large number of households. However, the message from an awareness campaign is most likely to resonate with households that already have a high level of motivation (Enthusiasts and Completers) and may assist those with a medium level of motivation (Middle Australia) to increase their level of motivation.

Awareness campaigns are unlikely to be effective in motivating tenants and rental providers to improving thermal control and improving energy-efficiency given the presence of the split incentives barrier.

Advice

Advice or non-financial support can be provided in the form of simple personalised information and tailored information.

Tailored information is required by those households that have a high ability level but a low level of motivation (Complacent and Competent), and high level of motivation but a low ability level (Dependent and Stuck), as well as Middle Australia. These households either do not have the motivation to seek out the information but have the skills to understand the information or have the motivation to seek out the information but will not necessarily understand the information and so they are not able to act upon that information. The tailored information needs to be proactively provided to these households who may not otherwise seek the information.

The provision of simple personalised information through a trusted source is required by those households with a low ability level and a low level of motivation (Cautious and Hard to help). The trusted source is required to communicate the information because these households have a low level of trust and skills. Unless the information is provided proactively in this way, these households will not seek out the information and increase their level of motivation to make a choice to improve the energy efficiency of their homes.

The provision of simple personalised information and tailored information may be effective for some tenants and rental providers, but not all. However, it would be a high-cost policy initiative to be able to tailor or personalise the information for each and every rental property, and ultimately provides no certainty that the thermal comfort of rented properties will be improved.

Incentives

The provision of some form of incentive for the installation of energy-efficiency features for rented premises (other than in the form of financial support which is discussed below) would be particularly effective for rental providers and tenants with a moderate to high level of ability and motivation (Enthusiasts, Completers and Middle Australia). As tenants and rental providers generally have a low level of motivation, due to the split incentives barrier discussed in Chapter 2, the provision of incentives is unlikely to be effective in motivating tenants and rental providers to invest in energy efficiency and thermal control features.

Financial support

The solutions identified that involve financial support are:

— providing grants
— facilitating/enabling increased availability of innovative funding vehicles
— funding energy savings measures in social housing.

The provision of financial support is an effective policy option where access to funds is the key barrier to making a decision to install ceiling insulation or draught proof, and where the access to funds increases the perceived benefits relative to the costs. It is effective where households have low opportunity due to a lack of liquid funds, but have the ability and motivation to take action, or low motivation but high ability and opportunity.

However, the provision of financial support is a high-cost policy option to install ceiling insulation and draught proofing in all rented premises in the ACT and provides no certainty that it will be done in each rented property.

Regardless of which policy option is pursued, government funding will be required to improve energy-efficiency and thermal control in social housing.

Support services

Support services are a very high-cost policy option in which community organisations provide one on one support to help households make choices. These services would most benefit those households with a low level of ability (Cautious, Hard to Help, Dependent and Stuck). Given the high cost, it is not an appropriate policy option for assisting a large cohort such as tenants and ensuring that no tenants are 'left behind'.

4.2.3 Identifying the appropriate initiative

Tenants fall into a naturally limited group of households. They inherently have limited rights and significant barriers with regard to investments in their homes, as a result of the split incentive problem. As a consequence, while they may be motivated to improve thermal control in their homes, and manage energy use and costs, they are not motivated or able to invest in thermal control and energy-efficiency of their homes.

The only policy option that would be effective in ensuring a minimum level of thermal comfort for all rental households is through regulation. Other policy options have either been tested already, are either likely to be ineffective, for example general awareness campaigns, or come at a very high cost, for example, funding the installation of ceiling insulation for all rented premises.

4.2.4 Regulatory approaches

There are a number of ways in which regulation can assist households to improve the thermal comfort of rented homes. These include to:

- mandate energy efficiency disclosure
- enforce an energy-efficiency standard on rental properties
- enforce the provision of energy-efficiency features in rental properties.

The ACT already mandates disclosure of energy-efficiency for rental properties where a rating already exists — though the existing mandate could be strengthened — it is not considered as an additional approach here. Regulatory approaches which drive improvements to thermal comfort and energy-efficiency typically take the form of prescribed minimum standards. For rental properties, the obligation to meet these standards typically falls on rental providers to provide thermal control features.

Two types of minimum standards exist for thermal control and energy-efficiency:

- **Performance-based standards** require rental providers to upgrade their properties' overall energy efficiency performance to a specified level, as measured by a tool or system chosen by the government. These standards allow rental providers to select the upgrades that will contribute towards the achievement of the mandated standard.
- **Features-based standards** mandate the types of upgrades that must be undertaken for a property to be legally eligible for lease to potential tenants (or alternatively, the standard that must be complied with at the point of repair or replacement). With each type of upgrade, the rental provider can still choose the particular brand, model or product, as long as it meets the required standard set by the government.

Both performance-based and features-based approaches have been taken in other jurisdictions. A review of minimum standards for rental properties in other jurisdictions is provided in Appendix A.

Performance-based standards are relatively more complicated than features-based standards, and typically have higher administration and compliance costs. However, given the holistic nature of thermal control in households, they allow more flexibility for rental providers (and households generally) to improve thermal control and energy efficiency in ways that best suit their conditions — potentially improving outcomes and lowering costs.

While all households will be able to improve the energy efficiency of their homes through raising mandatory codes and standards, those households for which these types of initiatives are most appropriate are those that have low ability (Dependent, Stuck, Cautious and Hard to help) and would not take action in the absence of regulation. They are also appropriate initiatives for middle Australia and for households with a high ability level but have a low level of motivation and/or are tenants (Complacent and Competent).

Households that have high ability and high motivation (Enthusiasts and Completers) can benefit from the availability of energy ratings and energy efficiency disclosure without the necessity to mandate them. However, as discussed above, tenants and rental providers generally do not have high motivation to invest in thermal control and energy-efficiency.

4.3 Options considered

This section outlines the approaches considered in detail in the remainder of this RIS. The options comprise one performance-based option and two features-based options. A business as usual option (no additional regulation) has also been considered and is used as a comparison for the other options.

Two standards have been considered for each of ceiling insulation and performance standards. These are additional sub-options.

For each of the three regulatory options considered, a two-year and a four-year phase in period has been considered as sub-options. For each option, a rental provider must meet the standards at the start of a new tenancy or at the cut-off date of each phase-in period.

In total, three options with two additional stringency standards, with two phase-in periods each have been considered for a total of ten modelled options considered — in addition to business as usual (see Figure 4.5).

Figure 4.5 Modelled options

	Ceiling insulation standard	Energy-efficient heater standard	Performance standard
2-year phase in	a) R3 ceiling insulation b) R5 ceiling insulation	e) Provision of an energy efficient heater	g) 2 star standard h) 3 star standard
4-year phase in	c) R3 ceiling insulation d) R5 ceiling insulation	f) Provision of an energy efficient heater	i) 2 star standard j) 3 star standard

Source: ACIL Allen

Stakeholder perspectives

Stakeholder opinions on the proposed options were mixed. From consultation with groups representing tenants, rental providers, industry and the community, no consensus preference emerged for one option over the other two. Some stakeholders believe that draught proofing should be included in place, or in addition to the features-based options to make them more effective. Stakeholder opinions on the proposed options are described in Appendix E.

Rental providers, tenants and owner-occupiers were asked about their preferences over the proposed options. Rental providers and owner-occupiers preferred a performance-standard most, and an energy-efficient heater least. Tenants preferred an energy-efficient heater most, and a performance-standard least. Details of the survey results are described in section F.2.

4.3.2 Business as usual

This option provides a baseline, against which the other options are compared. The business as usual case is a potentially preferred option if the positive impacts of regulation are not commensurate with the costs.

4.3.3 Ceiling insulation

Two ceiling insulation standard options are being considered:

— Rental homes with less than R2 ceiling insulation (see Box 4.1) are required to install/upgrade to a minimum of R3 with a phase in period.

— Rental homes with less than R2 ceiling insulation are required to install/upgrade to a minimum of R5 (or maximum possible where R5 is not possible) with a phase in period.

Box 4.1 R-value for insulation

The R-value of ceiling insulation is a measure of the ability of insulation to resist heat flow. It is given as R, followed by a number.

The R-value is a measured value of insulation material or of an installation of insulation materials. It is a function of the type of material, the thickness, and the way it is fitted. A higher R-value indicates a higher degree of thermal resistance, and therefore improved thermal control.

Newer buildings in Canberra require a minimum rooftop R-value of 4.1, and wall insulation R-value or 2.8. Meeting minimum whole-of-house energy efficiency standards often mean that R-values above this level are used, though the R-value varies from house to house.

While a material may have an R-value, the quality of the installation can affect the actual benefit. For example, even small gaps in the insulation may dramatically decrease performance. Accordingly, the National Construction Code makes adjustments for the minimum R-value of new constructions for the per cent of ceiling area uninsulated. For example, for a property to meet an R2.5 rating with between 4-5 per cent of the ceiling area uninsulated, the adjusted requirement is R5 materials to compensate. There is no adjustment possible with ceiling gaps of over 5 per cent (ABCB, 2019) – section 3.12.1.3. Likewise, materials may degrade over time which can affect the R-value.

The degree to which a particular R-value is appropriate depends on the climate. Warmer climates may require a lower R-value to provide thermal comfort, while alpine climates (like parts of the ACT) may only be comfortable at high R-values of R6 or more.

Source: ACIL Allen

4.3.4 Energy-efficient heater

The energy efficient heater standard being considered is:

— Rental homes without a fixed heater must install a minimum 1.5 star fixed electric heat pump heater that can heat the living area with a phase in period.[4]

[4] The EEIS scheme sets a minimum upgrade standard ranging from a Annualised Coefficient of Performance (ACOP) of 3.1 to 4.0 dependent upon the capacity of the unit (generally the larger the unit the lower the requirement). In terms of old stars (which is what the EEIS is based on) this equates to a range from 1.5 to 3.5 old stars. Under the new rating scheme this would be a range of 1.5 to 2.5 stars (noting however that the two rating types have some similarities but are not strictly comparable). The 1.5 star requirement above is under the new rating scheme.

- Rental homes with fixed resistance electric heater/s or a resistance electric concrete slab heater must be replaced with a minimum 1.5 star fixed electric heat pump heater that can heat the living area with a phase in period.
- Other heaters in rental homes must be replaced at end of life or, if demonstrably older than 20 years, within the phase in period, by a minimum 1.5 star fixed electric heat pump heater that can heat the living area.

4.3.5 Performance standard

The performance standard options being considered are:

- rental properties rated as 1 star or less must be upgraded to at least 2 stars with a phase in period, or
- rental properties rated as 2 stars or less must be upgraded to at least 3 stars with a phase in period.

A delayed start may be required as a suitable rating tool is not currently available (the current EER is not considered to be a suitable rating scheme for this purpose).

For the purposes of this analysis, the Victorian Scorecard will be assumed to be the rating tool. Using this tool, a 3-star rating corresponds to a dwelling having average energy costs and a 2-star rating corresponds to a dwelling having energy costs twice the average.

5 Impact analysis

This chapter provides the impact analysis of the policy options. Following best practice, it primarily considers the results of a cost-benefit analysis (CBA) of each of the options. The method of the cost-benefit analysis is described in detail in Appendix B. It considers the net impact on the ACT of each option — see section 5.2 — then describes the impacts on the primary stakeholders — see section 5.2.3. It explores the unintended impacts potentially attributable to the proposed policy options in section 5.3. Finally, it provides an analysis of the sensitivity of the major impacts to changes in key assumptions in section 5.4.

5.1 Impacts included in the analysis

The CBA is conducted by estimating a series of benefits and costs to the residents of the ACT. They are measured as the additional costs and benefits against a business-as-usual baseline scenario.

These costs are primarily the costs of upgrades and the ongoing administration of the prescribed standards. The benefits are primarily the net reduced energy costs associated with the thermal control and energy-efficiency upgrades, as well as other benefits stemming from changes to the energy mix and health benefits (see Figure 5.1).

Figure 5.1 Modelled impacts of the proposed options

+ Reduced energy costs
+ Improved air quality from domestic gas heating
+ Reduced domestic greenhouse gas emissions
+ Reduced renewable energy offsets
+ Reduced network costs

− Costs of upgrades - private
− Costs of upgrades - industry
− Costs of upgrades - public
− Administration and enforcement costs
− Industry costs (Only applicable to Performance standards)

+ Improved air quality from NSW power plants (Not attributable to ACT residents)

Source: ACIL Allen

A full description of these benefits and costs are given in section 5.1.1 and section 5.1.2, respectively. Details on how these benefits were estimated, and the data and assumptions underlying the modelling is included in Appendix B.

The impact analysis is conducted on a cohort for the first ten-years of the minimum standards – that is, those properties which have to upgrade in the first ten years. The impacts are measured over the life of those upgrades.

The net impacts are presented across the whole of society and do not present the impact on individuals. Where one individual feels a benefit of the same scale as — and related to — another's cost this is a transfer, which does not make the ACT community better off overall. An analysis of the distribution of these impacts is provided separately in section 5.2.4.

5.1.1 Benefits modelled

The benefits modelled include:

— **Energy benefits** – these are benefits from the saved cost of supplying energy. This is the most certain measure of benefits available and includes:
  - *Reduced energy costs* – the primary benefit of minimum standards for residential rental properties is reduced energy costs. These energy cost savings are realised through lower electricity, gas or firewood use by tenants. For a small subset of households, this is supplemented by offsetting rooftop solar and exports to the electricity grid.
  - *Reduced network costs* – the electricity network is built to provide electricity at peak usage. A reduction in the ACT's peak electrical usage will lower network costs associated with investments in additional transmission and distribution network capacity.
  - *Reduced renewable energy offsets* – the ACT has a 100 per cent renewable energy target. It contracts with renewable energy suppliers to ensure that this target is met, effectively offsetting electricity that is sourced from fossil fuels. The renewable energy suppliers are paid a feed-in support payment that reflects the difference between their costs and the revenue received through the wholesale electricity market. Reducing electricity use in the ACT thereby reduces the amount that is paid to offset the amount that would otherwise be paid to offset electricity that is sourced from fossil fuels.

— **Benefits from reduced domestic greenhouse gas emissions** – domestic burning of natural gas and firewood contributes to the ACT's greenhouse gas emissions. Where rental households burn less of either of these energy types, it will reduce greenhouse gas emissions. Because the ACT offsets its electricity sourced from fossil fuels, there is no greenhouse gas emissions benefit attributable to reducing electricity use. This is a somewhat more uncertain measure of benefit. It is clear that greenhouse gas emissions represent a cost to society, and that reducing these emissions therefore represents a benefit. However, since the removal of Australia's carbon pricing mechanism in 2014, there is no universally agreed transparent price which can be assigned to these emissions.

— **Health benefits** — three types of health benefits are modelled as outlined below. While it is clear that improved thermal control and energy efficiency can improve health in different ways, these benefits are generally regarded as highly uncertain, and estimates are speculative. They should be interpreted as an indicative potential value of the wellbeing that could be generated through energy efficiency upgrades. The true value in dollar terms of these benefits is unknown, but is expected, based on the information available, to be of the same order of magnitude as our estimates.
  - *Tenant health benefits* – as noted in section 2.3.1, poor thermal control has impacts on the health of tenants. These health benefits have been modelled as part of the sensitivity testing (see below).
  - *Health benefits related to improved air quality from domestic gas burning* – gas burning from domestic heaters results in emission of particulates which can result in respiratory and circulatory health impacts.
  - *Health benefits related to improved air quality from coal and gas power plants*– even though the ACT offsets its electricity sourced from fossil fuel, part of its electricity use is associated with coal or natural gas plants (predominantly in New South Wales). Burning

fossil fuels in these power plants produces particulate matter which is harmful to the health of surrounding residents. Despite not being a benefit attributable to the ACT, it is an auxiliary benefit of reduced electricity use.

Energy savings and tenant health benefits

Improving the thermal control and energy efficiency of rental properties mean that tenants can heat (or cool) their homes more easily at less cost. However, saving energy costs and improving thermal comfort are a substitute for tenants.

Improving the energy efficiency of a property does not guarantee that they will use less energy or that they will live in more comfortable homes — tenants will choose for themselves what their priorities are. For example, tenants may choose to heat their home to the same level as before the upgrade, taking any savings entirely as savings on their energy bill without any benefits to comfort and health. Alternatively, they may choose to spend the same amount on energy and improve the thermal comfort of their homes. In either case, the tenant is made better off, though they must decide how much they wish to save energy and how much to improve comfort.

For the purpose of the modelled scenarios, the comfort and health benefits have not been included, however they have been included as part of the sensitivity testing in section 5.4.4, below.

Rebound effect

The degree to which tenants increase their energy use (relative to the full saving) from improved energy efficiency is referred to as the rebound effect. It may take three forms:

1. the take-back effect, where energy users increase their consumption of energy using services (e.g. heating)
2. the spending effect, where energy users spend financial savings from energy efficiency on other energy consuming activities
3. the investment effect, where investment in energy efficiency leads to an indirect increase in economic activity and energy consumption.

The energy efficiency literature often makes note of this rebound effect as a contributing explanatory factor for the differences between projected and actual energy savings. Increased energy use may, in part, help explain improved health impacts of the proposed options.

Empirical evidence suggests that the rebound effect is real. However, the evidence also suggests that the magnitude of the effect is highly variable and context specific.

- Modelling done by Tony Isaacs and Robert Foster for a 2011 mandatory disclosure Regulation Impact Statement included a 30 per cent rebound effect (that is, it included a 30 per cent discount to energy savings) (Allen Consulting Group, 2011).
- McKinsey (2009) refers to a rebound effect of 15 to 30 per cent.
- A report by the IEA (2015) on the multiple effects of energy efficiency refers to a total macroeconomic rebound effect in the range of 10 per cent to 30 per cent in the UK and suggests the rate is similar in other developed countries and higher in developing countries.
- O'Leary (2016) suggests that the rebound effect for efficiency alone should be nearer the low end of estimates of around 5 per cent to 10 per cent of expected energy savings.

Stakeholders consulted for this and other ACIL Allen energy efficiency projects were of the view that the rebound effect when insulating uninsulated or poorly insulated homes could be high — as the home would be able to retain the heat (or cool) with insulation installed or upgraded, the tenant would be willing to pay more to heat (or cool) their home so that they were more comfortable.

Given the uncertainty associated with the rebound factor, we have assessed the energy savings based on a rebound factor of 10 per cent. This implies that the majority of the benefit is received as reduced energy costs, where benefits are more easily and accurately estimated. However, given tenants can choose more or less thermal comfort depending on their priorities, this should be understood as a lower bound estimate of benefits. We have conducted a sensitivity test on this in section 5.4.4, though the results are not substantially affected by a change in this estimate.

5.1.2 Costs modelled

The costs modelled include:

— **Private upgrade costs** – These are the costs to rental providers in money and time. Costs include the capital costs required to make upgrades, the costs of inspections (as required), rectification costs required to make the upgrade (such as fixing roof cavities or installing compliant electrical components) and the time taken to organise and make upgrades.

— **Industry upgrade costs** – Approximately 92 per cent of rental properties are managed by property managers. The time required for these property managers to organise upgrades are included as a cost. For some, these costs will be passed through to rental providers.

— **Public upgrade costs** – These are the costs for Housing ACT to upgrade its housing stock. These costs mirror those for private housing, including provision for full time staff to manage the upgrades, costs for inspecting and rectification, and the capital costs of upgrading the properties.

— **Administration and enforcement costs** – These are the costs for the ACT Government to implement the proposed minimum standards, including education costs, and the costs associated with administration and enforcement. These costs are assumed to be invariant between the proposed options. The costs of any complementary measures to assist rental providers with the cost of the upgrades (e.g. subsidies and rebates) are not included in the modelling as they represent a transfer of costs.

— **Industry costs** – For the performance standards, additional training will be required for industry to provide Scorecard-like performance ratings. Additionally, these assessors require insurance during the period they are operating.

5.2 Net impacts

A summary of the net impacts of the proposed options is shown in Table 5.1. The results show that the insulation standards provide a net benefit to society, from around $10 million in net present value (NPV) terms for the R3 insulation (option a) to $18 million for R5 (option d). These options return between $1.19 and $1.30 for every dollar of cost, As reflected in the benefit-cost ratio (BCR).

The table indicates that, at a society-wide level, the heater and performance options are a net cost. A negative NPV or a BCR of less than one indicate a net negative policy even when including the somewhat more uncertain measures of benefits (the benefits from reduced greenhouse gas emissions and health benefits).

Table 5.1 Headline results, economy-wide analysis

Option modelled	Benefit-cost ratio (BCR)	Net present value ($m)
a) Insulation R3 - 2 year	1.19	$10.44
b) Insulation R3 - 4 year	1.21	$11.08
c) Insulation R5 - 2 year	1.29	$17.42
d) Insulation R5 - 4 year	1.30	$18.01
e) Heater - 2 year	0.59	-$15.56

Option modelled	Benefit-cost ratio (BCR)	Net present value ($m)
f) Heater - 4 year	0.59	-$15.56
g) Performance 2-stars - 2 year	0.46	-$12.95
h) Performance 2-stars - 4 year	0.47	-$12.76
i) Performance 3-stars - 2 year	0.49	-$119.66
j) Performance 3-stars - 4 year	0.50	-$116.41

Note: All impacts are calculated in present value (using a three per cent discount rate) over the life of the upgrades.
Source: ACIL Allen

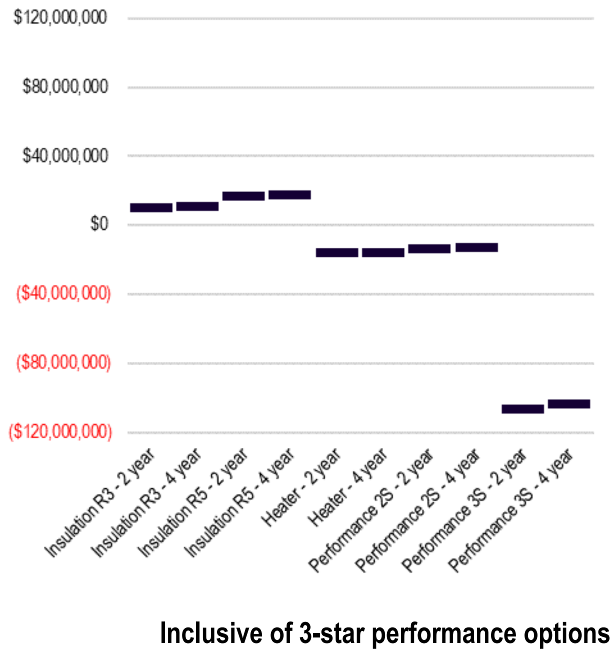
The negative results for the heater and performance options are mainly driven by the use of wholesale energy prices and avoided network costs to value the benefits of reduced energy consumption which, as noted in Appendix B, results in BCRs and NPVs that are much lower than if retail energy prices were used. The energy benefits are quantified using wholesale energy prices and avoided network costs (as a proxy for the avoided resource costs) rather than the retail costs avoided by the tenant because a large proportion of the costs avoided by the tenant are unavoidable fixed costs that are transferred to the retailer and network businesses and recovered from other electricity customers. As a consequence, these unavoidable fixed costs do not represent net gains to society (see section 5.2.4 for more information).

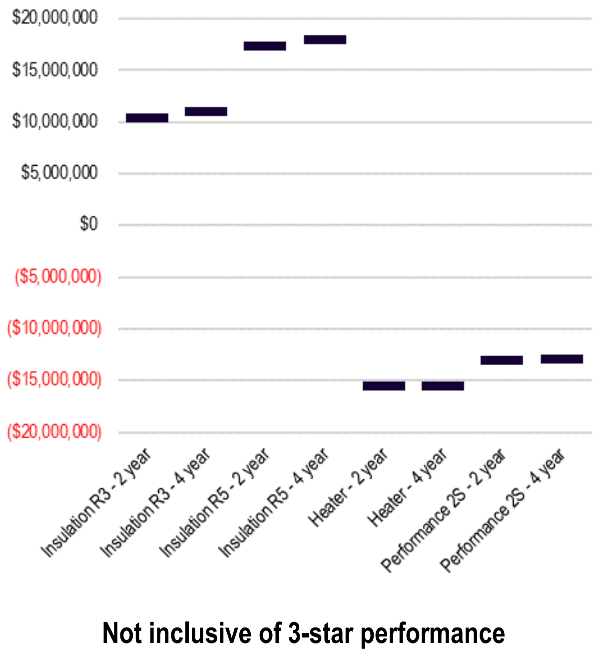
The effect of using wholesale energy prices and avoided network costs (as a proxy for the avoided resource costs) is compounded by the current period of low wholesale energy prices driven by a number of government policy initiatives that incentivise the entry of new energy supply options and a reduction in the demand for energy.

The net present value of the proposed options are shown in Figure 5.2. The results are shown with a discount rate of three per cent. Insulation, which has a relatively long life-span relative to heaters, has impacts much longer into the future, and therefore have much higher net present values than much shorter-lived upgrades such as the heater option.

As the results for the 3-star performance standard options are a magnitude larger than the other proposed options, they are shown with and without those options to provide greater clarity.

Figure 5.2 Net present value, 3 per cent discount rate





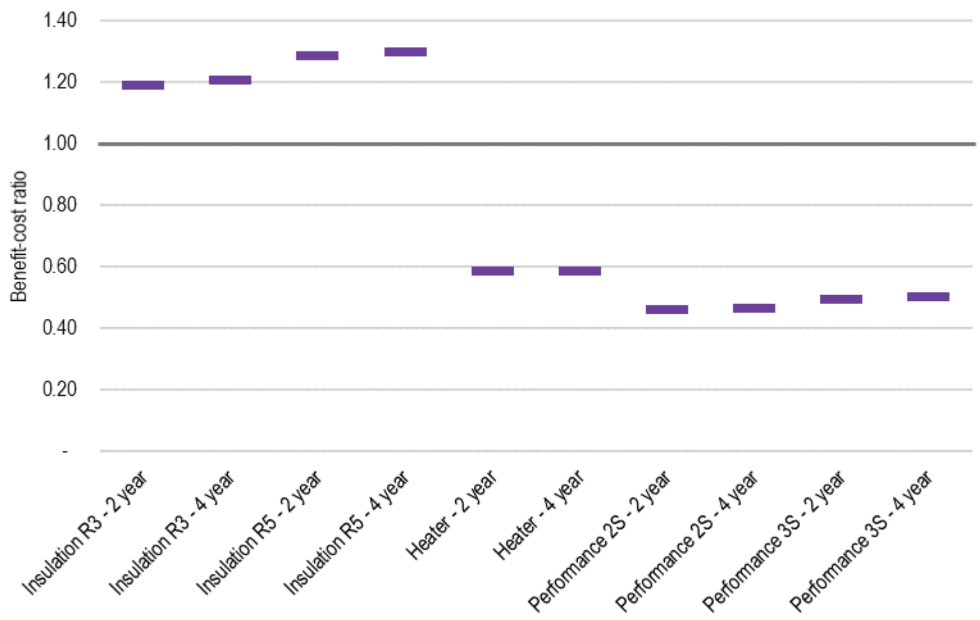
Source: ACIL Allen

The benefit-cost ratio of each of the proposed policy options are given in Figure 5.3. A BCR of greater than one indicates a policy with net benefit to society. However, the BCR does not indicate the relative scale of the options — that is, a BCR is a ratio of costs and benefits. Options with the same BCR can have very different net present values. For example, the BCRs for the 3-star performance standard options are on par with the 2-star performance standard options, but the net present value of the 3-star performance standard options has much larger negative numbers than of the 2-star performance standard options. It is important to note that the BCR can hide two types of scaling:

— both costs and benefits are scaled equally (for example, both the per upgrade costs and the per upgrade benefits of the 3-star performance standard options are greater than of the 2-star performance standard options)

— the number of properties that have to upgrade is scaled (for example, the modelling assumed more than twice as many properties require improvements to insulation as require improvements to the heater).

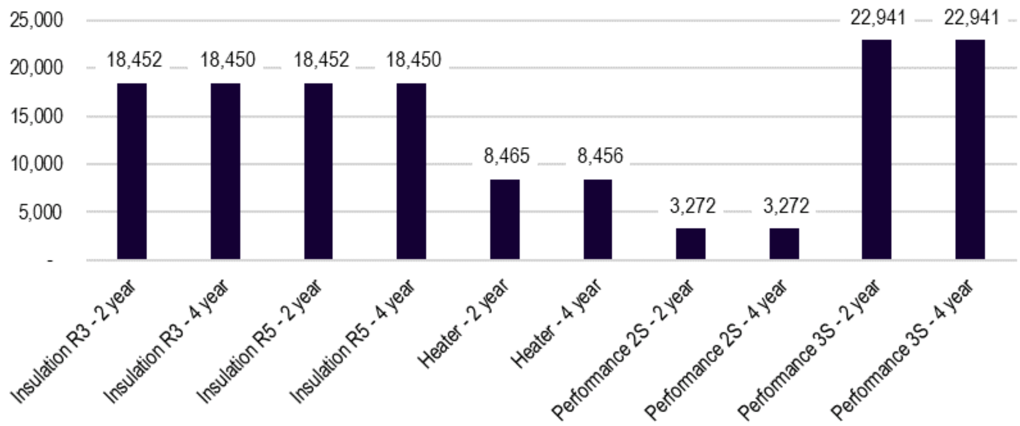
Figure 5.3 Benefit-cost ratio, 3 per cent discount rate



Source: ACIL Allen

The scale of the results for each of the proposed policy options is a function of the number of properties to which the proposed policy option is applicable. For example, it is estimated that more than twice as many rental properties will require an upgrade of ceiling insulation (18,450) as will be required to upgrade to an energy efficient heater (8,465), which is more than twice as many as those that will be required to upgrade to 2-stars (3272). The number of properties upgraded are shown in Figure 5.4.

Figure 5.4 Number of properties upgraded per scenario



Source: ACIL Allen

The net present value per upgrade shows the relative impact of each option scaled by the number of properties affected. These results are important, because estimates of the proportion of properties which would need to be upgraded are uncertain. The per upgrade results show that while the 3-star option is still the worst option, it is more comparable to the other results than the overall impacts show (see Figure 5.5).

Figure 5.5 Net present value – per upgrade

Source: ACIL Allen

While the impacts quantified for this analysis result in a net cost to society for some of the options, it is important to consider that:

— In addition to the impacts outlined in 5.1.1, there is now a considerable body of evidence that indicates that there are other multiple impacts (both costs and benefits) associated with energy efficiency – both private and public. These multiple impacts include the impacts of energy efficiency on:
  — increased health and wellbeing[5]
  — the energy system

[5] The potential health benefits have been partly estimated, as have the NSW-based benefits from reduced pollution associated with electricity generated from fossil fuels, and gas use.

— the overall economy.

Despite the considerable body of international evidence on the value of these multiple impacts of energy efficiency[6], there is an absence of Australian-specific estimates to enable these impacts to be quantified, and of a holistic framework for applying existing international research to the Australian context. Given this, some of these impacts have only been discussed qualitatively in this analysis (see section 5.3). However, it is important to note that some of these non-energy benefits could be of greater value than the energy savings delivered by the policy options being analysed.

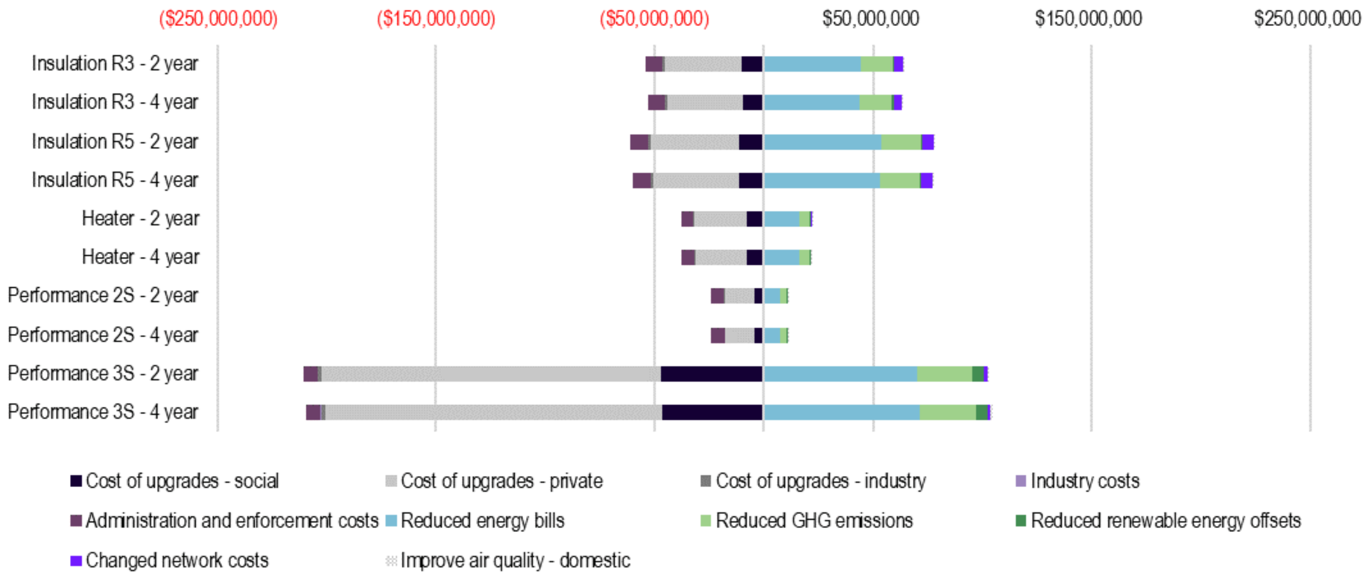
— The energy efficiency measures installed as a result of a minimum standard would deliver net benefits at the household level (see section 5.2.3). These benefits are particularly significant to low-income households in the context of energy bill pressures and fuel poverty (see section 2.2).
— There are a number of recent policy developments driving the case to improve energy efficiency of residential buildings. These include:
  — the Paris Agreement, under which Australia has committed to reduce greenhouse gas emissions by 26 to 28 per cent on 2005 levels by 2030. The Australian Government has stated that it is aiming to overachieve on this target and that it aims to reach net zero emissions as soon as possible, preferably by 2050. As noted by CIE (2018), the domestic challenge is to achieve these targets at least cost and energy efficiency is often cited as a low (or in some cases negative) cost approach to achieving greenhouse gas abatement.
  — the National Energy Productivity Plan (NEPP) (COAG Energy Council, 2015), which sets a target of improving Australia's energy productivity by 40 per cent by 2030 on 2015 levels and includes a number of measures to reduce the energy use of the residential building sector.
  — the Trajectory for Low Energy Buildings (COAG Energy Council, 2020), which sets a plan towards zero energy (and carbon) ready buildings for Australia and identifies opportunities for the building sector. The Trajectory suggests a number of targeted building policies to improve the energy efficiency of existing buildings in Australia.

The composition of the net impacts is given in Figure 5.6. The cost of making the upgrades — for both rental providers and for Housing ACT — are the largest costs. Reduced energy costs are the largest benefit by a substantial margin. Reduced wholesale energy costs represent the bulk of the benefits of the policy, representing between 4.2 (for performance options) and 6.6 times (for R5 insulation options) larger than the other benefits combined.

Health benefits from reduced energy production from black coal and gas power plants, largely attributable to NSW residents, are not shown, however these are largely negligible compared with the other impacts.

[6] See for instance, the COMBI project in Europe: https://combi-project.eu/.

Figure 5.6 Composition of net impacts



Source: ACIL Allen

Phase-in periods

The net impacts associated with the four-year phase-in variations of the policy options are slightly better than the two-year phase-in versions. Given the options cover roughly the same number of upgrades, the additional benefit comes from slightly delaying costs in the case of the four-year option. At a three per cent discount rate, the slightly longer phase-in improves the net impacts by between 1 and 6 per cent. Because the majority of tenancies for private rentals are re-signed each year, with a far fewer in each year following, the longer phase-in impacts only a few properties. Only a small proportion of leases are longer than three years.

Some additional properties, which are not compliant with the proposed minimum standards, will enter the rental market each year. These will create a 'long-tail' of upgrades each year after the phase-in period, as captured in the remaining years of the ten-year cohort (and into the future).

5.2.1 Time profile of impacts

The time profile impacts can largely be separated into three periods:

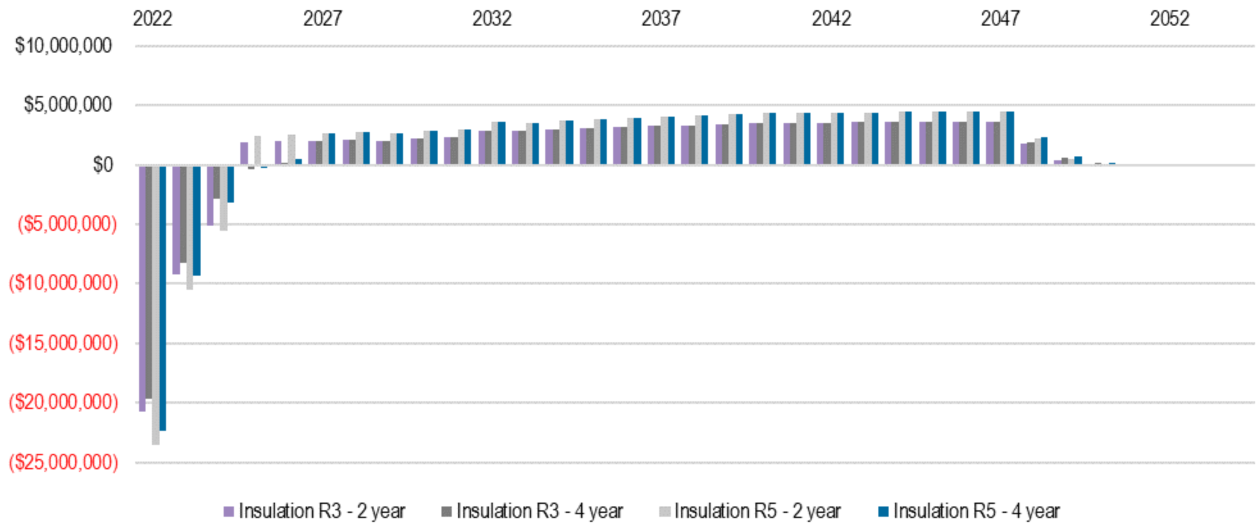
— The up-front investment in meeting minimum standards through upgrading rental properties. This report includes the modelled results of a ten-year cohort (2022-2031). In reality, a small number of properties will continue to be upgraded each year as they enter the rental market for the first time. This number will be slightly higher for the heaters, as older appliances will need to be replaced more often.

— The middle period, which largely is defined by reduced energy costs and ongoing administration and enforcement costs. Given costs are low and benefits are high, this period is when the net benefits largely occur. The length of this period is defined by the lifespan of the upgrades. This varied from 25 years (or more) for insulation, to around 12 years for heating appliances.

— The tail period, in which the upgrades begin to break down and will require replacement. This period is similarly around ten years, which reflects the ten-year cohort modelled.

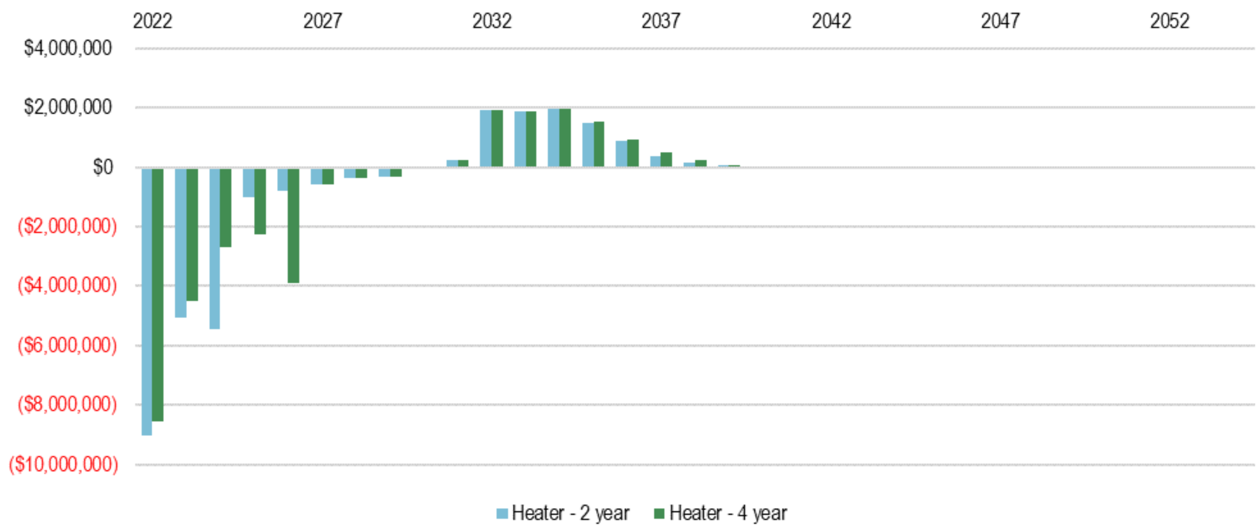
The time profile of impacts for the insulation options is given in Figure 5.7 and the time profile of impacts for the heater options is given in Figure 5.8.

Figure 5.7 Time profile of impacts – insulation options



Source: ACIL Allen

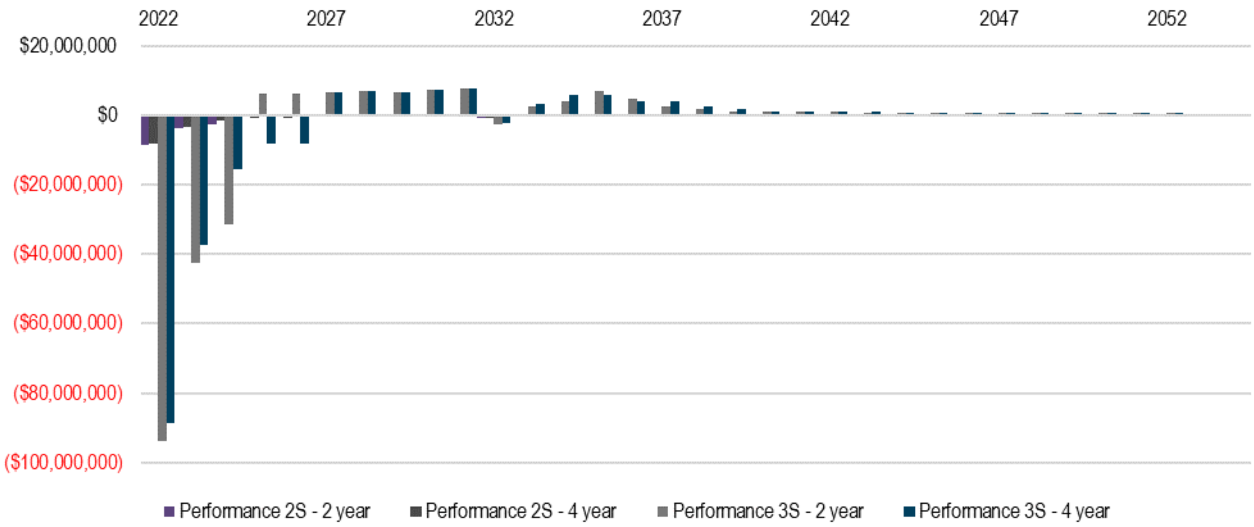
Figure 5.8 Time profile of impacts – heater options



Source: ACIL Allen

The time profile of impacts for the performance options are given in Figure 5.9. In addition to the three periods described above, there is a second period of capital costs, to replace inverters to allow operation of the solar photovoltaics over their full lifespan, which occurs after the first ten years. The performance options include a range of upgrades, with a different life for each of those upgrades, with appliances breaking down earliest, followed by more longer-lived upgrades. The period over which the upgrades depreciate and breakdown is therefore more staggered and smoother than either the insulation or heater options.

Figure 5.9 Time profile of impacts – performance options

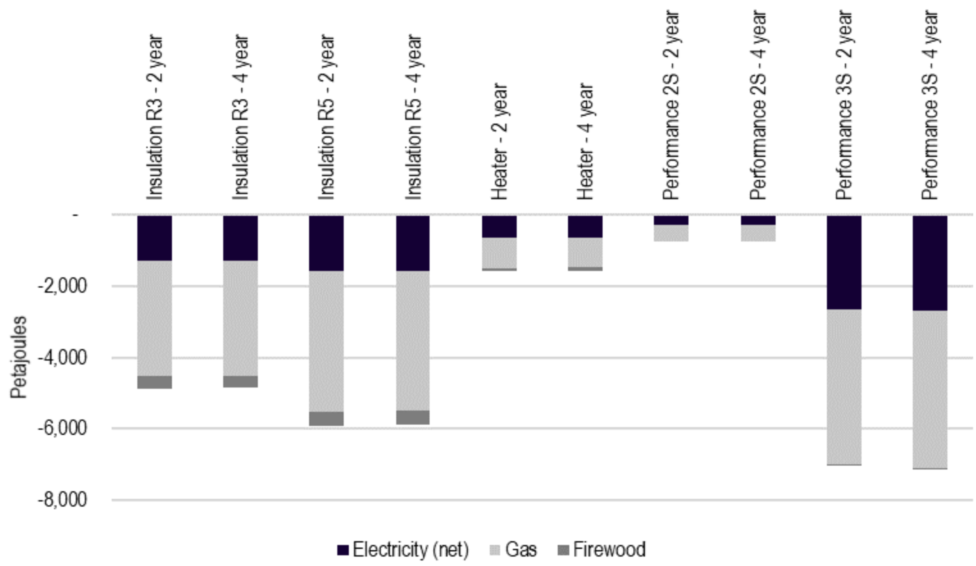


Source: ACIL Allen

5.2.2 Energy and environmental impacts

Improvements in the energy-efficiency of the housing stock will reduce the energy usage and therefore have environmental benefits. The 3-star performance options have the greatest reduction in energy use (over 7,000 petajoules over the period). Insulation performs relatively well, reducing the energy use required for many properties. The heater and performance options have the capacity to substitute one energy use for another energy use to decrease costs, without necessarily decreasing overall energy use. The total change in energy use is given in Figure 5.10.

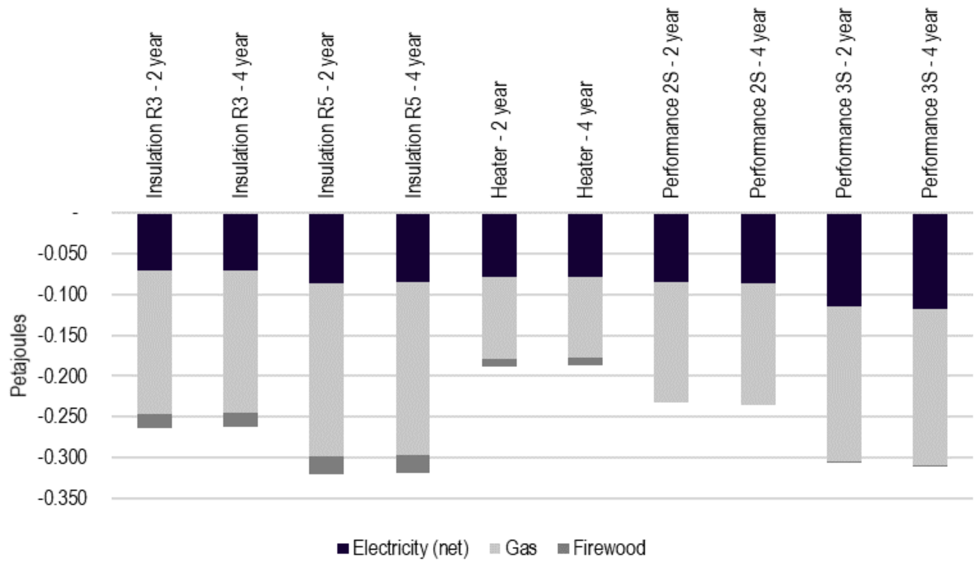
Figure 5.10 Total change in energy use, lifespan of analysis



Source: ACIL Allen

As noted above, the number of rental properties which are upgraded under each minimum standard varies significantly. It is important to note that the options each have different effects on the annual energy savings, which are further modified by the relative life-span of each upgrade. The amount of energy use reduced per upgrade for each option is given in Figure 5.11. The total change in use associated with the heater and 2-star performance options is low relative to the insulation or 3-star performance options as far fewer rental properties are upgraded but the energy change per upgrade is reasonably similar.

Figure 5.11 Energy change per upgrade, lifespan of analysis

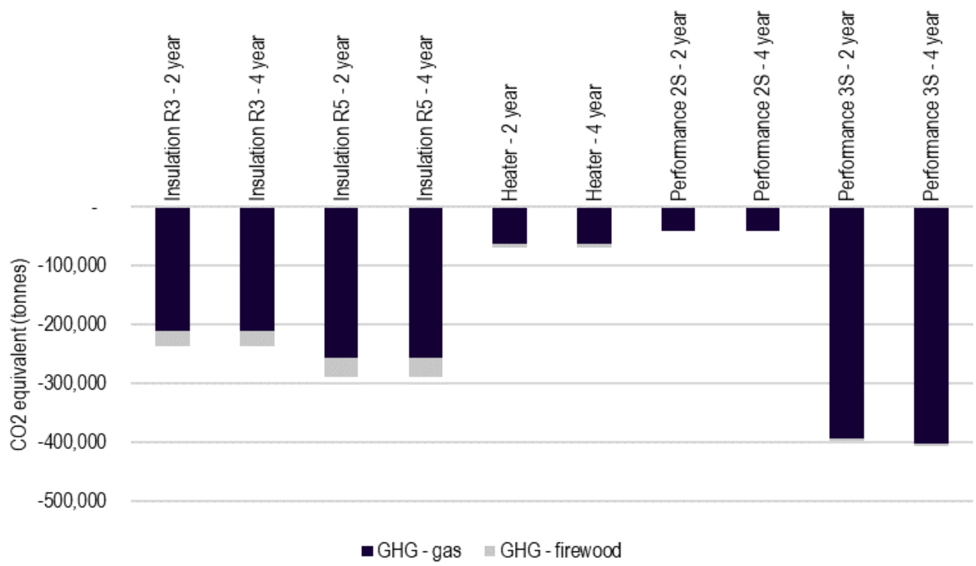


Source: ACIL Allen

Domestic use of natural gas and firewood contributes to the greenhouse gas emissions for the ACT. Given the ACT offsets the greenhouse gas emissions from its electricity use, savings of electricity do not avoid greenhouse gas emissions (though would save money on renewable energy offsets).

As illustrated in Figure 5.12, the greenhouse gas emissions that are avoided from gas with the upgrades are far larger than from firewood, given gas is a more prevalent heat source. In line with the energy savings, the 3-star performance option avoids the most greenhouse gases, followed by the R5 insulation option.

Figure 5.12 Avoided greenhouse gas emissions, lifespan of analysis



Source: ACIL Allen

5.2.3 Distributional impacts

As is standard practice, the cost-benefit analysis of the scenarios for a minimum performance standard for rental properties in the ACT was undertaken from the perspective of the broader ACT community, with impacts that are transfers between stakeholders (such as between the government and households, between tenants and rental providers, and between households that undertook an upgrade and those that did not) netted out. Nevertheless, it is important to consider the implications of some of these transfers on stakeholders.

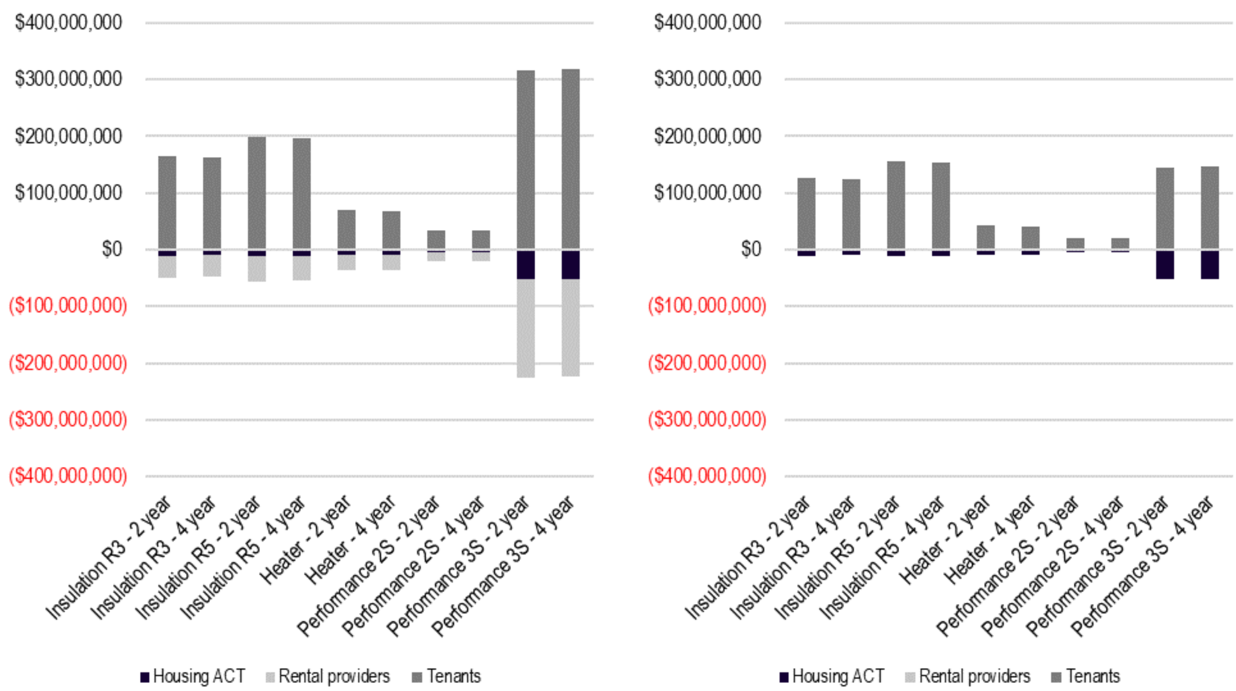
Impacts on tenants

Tenants will be made better off by each of the proposed policy options. They will benefit primarily from reduced energy costs, and to some degree by improved health and wellbeing. The effect on these households is measured using the retail energy costs, rather than wholesale energy and avoided network costs, which leave them better off, over and above the avoided resource cost. The difference between the retail energy costs and the wholesale energy and avoided network costs are transferred to others in the community.

Tenants will likely pay for some (and potentially in some cases all) of the benefits received through additional rent to pay for the cost of the upgrades. Representatives of both tenants groups and rental provider groups acknowledged that this would likely be the case (see section E.4.2), and about 56 per cent of tenants who responded to the survey said they would be prepared to pay some portion of the energy savings as increased rent (see section F.6).

The effects on tenants, with and without full cost pass-through is shown in Figure 5.13. Housing ACT indicated there was no capacity to increase rents for public housing, and hence no cost pass-through is possible for public housing residents. The results show that even with full cost pass-through, tenants are left better off overall.

Figure 5.13 Total impacts on tenants and rental providers



Without cost pass-through **With full cost pass-through**

Source: ACIL Allen

The average impacts for each affected tenant household are given in Table 5.2. These are presented with no cost pass-through of the net costs to rent and with full cost pass-through (the total cost of the upgrade is passed through as increases in rent over time). With no cost pass-through of the net costs to rent, the 3-star performance standard has the most significant benefit for tenants as it has the greatest reduction of energy use on a per upgrade basis. The heater option provides the lowest benefit to tenant households on a no cost pass-through basis.

However, it is likely that many private rental providers will pass through some or all of the costs of meeting minimum standards as rent increases over the life of the upgrade. Looking at the tenant household impacts with full cost-pass through suggests that even with full cost pass-through, tenant households in private rental properties will still be better off. When these costs are included, the tenant household benefits the most from an R5 insulation minimum standard and the least from the heater option.

Table 5.2 Average tenant household impact

Scenario	With no cost pass-through ($ NPV)	With full cost pass-through ($ NPV)	
	Tenant benefit	Upgrade costs for private rental providers / increase in rent	Net benefit
a) Insulation R3 - 2 year	$8,914	-$2,070	$6,844
b) Insulation R3 - 4 year	$8,825	-$2,032	$6,794
c) Insulation R5 - 2 year	$10,819	-$2,388	$8,431
d) Insulation R5 - 4 year	$10,712	-$2,349	$8,362
e) Heater - 2 year	$8,162	-$3,189	$4,973
f) Heater - 4 year	$8,042	-$3,174	$4,868
g) Performance 2 star - 2 year	$10,566	-$4,650	$5,916
h) Performance 2 star - 4 year	$10,612	-$4,635	$5,976
i) Performance 3 star - 2 year	$13,813	-$7,531	$6,282
j) Performance 3 star - 4 year	$13,900	-$7,506	$6,394

Note: The values in the tables are the net present value at a 3 per cent discount rate. The results are averaged over all households.

Note: Individual upgrade costs will vary significantly between rental properties. Further, Class 2 properties are generally significantly cheaper than Class 1 properties. More details on data and assumptions regarding upgrade costs are available in Appendix B.

Source: ACIL Allen

The results for individual households will vary depending on:

— the initial condition of the property prior to upgrading

— the proportion of the net costs that are passed through to rent (that is, no cost pass-through, partial cost pass-through, or full cost pass-through)

— whether the household is in public or private housing

— the nature and expense of the upgrades required.

Government subsidy

It is possible, and even likely, that some tenant households will be made worse-off overall unless the regulations and associated government programs prevent or reduce cost pass-through to renters. However, as noted in section 4.1.1, the ACT Government provides several programs which help manage energy-efficiency improvements or assist with costs. Any subsidy does not increase or decrease the net value of the program at the economy-wide level. It is just a transfer from the government to individual households. The costs and benefits of the program remain the same.

To illustrate how an $800 subsidy would affect the impacts on households, Table 5.3 replicates Table 5.2 with the subsidy applied. Importantly, a subsidy has the potential to help both rental providers and tenants:

— A subsidy will help rental providers with upfront costs. The burden of the up-front cost is a particular concern for rental providers, particularly for those with the least capacity to pay.

— A subsidy has the capacity to lower the increase in rent passed through to tenants, increasing the net benefit to tenants even with full cost pass through.

Table 5.3 Average tenant household impact – with $800 subsidy to rental providers

Scenario	With no cost pass-through ($ NPV)	With full cost pass-through ($ NPV)	
	Tenant benefit	Upgrade costs for private rental providers / increase in rent	Net benefit
a) Insulation R3 - 2 year	$8,914	-$1,270	$7,644
b) Insulation R3 - 4 year	$8,825	-$1,232	$7,593
c) Insulation R5 - 2 year	$10,819	-$1,588	$9,231
d) Insulation R5 - 4 year	$10,712	-$1,549	$9,163
e) Heater - 2 year	$8,162	-$2,389	$5,773
f) Heater - 4 year	$8,042	-$2,374	$5,668
g) Performance 2 star - 2 year	$10,566	-$3,850	$6,716
h) Performance 2 star - 4 year	$10,612	-$3,835	$6,777
i) Performance 3 star - 2 year	$13,813	-$6,731	$7,082
j) Performance 3 star - 4 year	$13,900	-$6,706	$7,194

Note: The values in the tables are the net present value at a 3 per cent discount rate. The results are averaged over all households.
Note: Individual upgrade costs will vary significantly between rental properties. Further, Class 2 properties are generally significantly cheaper than Class 1 properties. More details on data and assumptions regarding upgrade costs are available in Appendix B.
Source: ACIL Allen

Impacts on private rental providers and the rental market

Impacts on rental providers are a function of the capital costs of the upgrades, the increased maintenance costs associated with the upgrades (where applicable), the tax benefits, and the proportion of the net costs that can be passed through to tenants in the form of increased rents. Accordingly, the same investment in ceiling insulation will have different impacts on two different rental providers. The total impacts on rental providers with and without cost pass-through are given in Figure 5.13. This includes the upgrade costs to rental providers, with and without cost pass-through.

Given the extremely low vacancy rates — about 0.9 per cent, the lowest of any capital city — the ACT rental market is a 'sellers' market' where rental providers have stronger negotiating positions. Accordingly, the degree of cost pass-through will be predominantly governed by the response from rental providers.

Impacts on rental returns

The impacts on rental returns for a Class 1 (house or townhouse) and Class 2 (unit or apartment) for median rent and median house prices are given in Table 5.4 and Table 5.5. The analysis provides a general picture of the scale of the impact on rental returns for a general property. The results assume no cost pass-through. They assessed the impact of the insulation standard on rental properties to be in the order of $100 per annum, or around $2 per week.

Table 5.4 Impacts on rental return for Class 1 properties

Scenario	Annual cost	Per cent of weekly median rent	Total cost as a per cent of median property value (change in rental return)
Insulation R3	$133.72	0.45%	0.17%
Insulation R5	$163.82	0.55%	0.21%
Heater	$274.15	0.92%	0.35%
Performance 2 stars	$347.60	1.17%	0.45%
Performance 3 stars	$589.24	1.99%	0.76%

Note: Phase-in rates do not impact the rental return for individual rental providers.

Note 2: Assumptions underlying the analysis: Holding period – 10 years; marginal tax rate including Medicare levy – 39 per cent; discount rate 4 per cent.

Note 3: Data underlying analysis: Median Class 1 house price - $780,000; median 3 bedroom house rents - $570 *(CMTEDD, 2021)*.

Note 4: The analysis provided in this table is general in nature and not representative of any individual rental property investor. It is not intended or suitable to be used for individual investment decisions.

Source: ACIL Allen

Table 5.5 Impacts on rental return for Class 2 properties

Scenario	Annual cost	Per cent of weekly median rent	Total cost as a per cent of median property value (change in rental return)
Insulation R3	$67.95	0.25%	0.14%
Insulation R5	$77.61	0.29%	0.16%
Heater	$149.76	0.55%	0.30%
Performance 2 stars	NA	NA	NA
Performance 3 stars	$314.44	1.16%	0.63%

Note: Phase-in rates do not impact the rental return for individual rental providers.

Note 2: Assumptions underlying the analysis: Holding period – 10 years; marginal tax rate including Medicare levy – 39 per cent; discount rate 4 per cent.

Note 3: Data underlying analysis: Median Class 2 unit price - $500,000 *(Allhomes, 2021)*; median 2 bedroom unit rents - $520 *(CMTEDD, 2021)*.

Note 4: The analysis provided in this table is general in nature and not representative of any individual rental property investor. It is not intended or suitable to be used for individual investment decisions.

Source: ACIL Allen

The results in Table 5.4 and Table 5.5 indicate that the minimum standard options are unlikely to have sizable impacts on the rental returns for all rental providers. The impacts, assuming no cost pass-through, are likely to be marginal for most investors. However, the impacts may be material for some rental providers with already low rental returns, or for those with low property values which require the most extensive upgrading to meet the minimum standards.

These results are based on the average net present value upgrade costs per unit (inclusive of inspections and rectification costs as required) for each scenario of:

— insulation R3 $2,070
— insulation R5: $2,388
— heater: $3,189
— performance 2-star: $4,650
— performance 3-star: $7,506.

More information on upgrade costs is included in section B.2, and are sensitivity tested in section 5.4.5 and section 5.4.6.

Liquidity constraints

During the stakeholder consultation process, several groups identified that unexpected large capital outlays (for example, having to upgrade the insulation of a rental property) may put unbearable short-term pressures on some rental providers. Examples were given by groups representing real estate agents and financial advisors that some rental providers may be unable to afford existing unexpected maintenance costs — and that further costs would push some rental providers into mortgage stress. This is likely to lead to some rental providers selling their properties which in turn is likely to result in the property being upgraded to be more energy-efficient, or demolished and redeveloped, whether it is purchased by an investor or an owner occupier.

Unquantified benefits of the minimum standards to rental providers

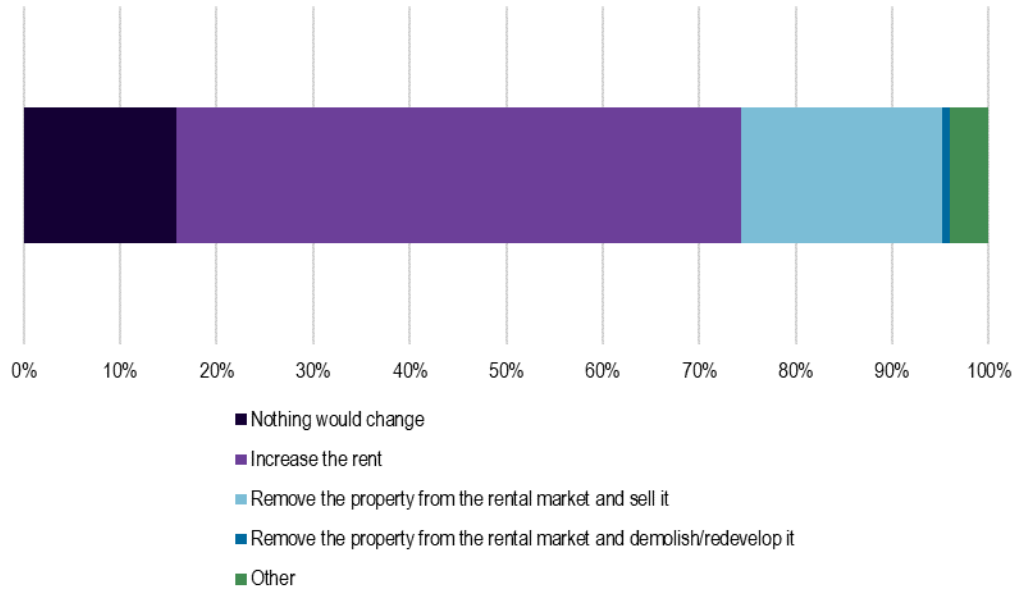
It was noted by several stakeholders in separate workshops that there are a number of potentially beneficial impacts for rental providers, which can positively affect returns for rental providers:

— Greater tenant retention in comfortable houses – for instance, tenants who come from other areas who are unfamiliar with Canberra's climate often choose to move tenancies after the initial lease period to find a more comfortable home.
— Greater security of income – for some rental properties, improved energy efficiency will result in reduced bills which has the potential to alleviated financially-stressed household budgets. As a result, for some rental providers, they will secure more reliable rental incomes.
— Capital appreciation – investments in thermal comfort and energy efficiency make properties more appealing to buyers. As a result, some rental providers will garner some capital appreciation from investments in the property.

Response from rental providers to minimum standards

ACIL Allen asked rental providers how they would respond to minimum standards on their existing rental properties. It is important to note that they were asked before details on the proposed standards were available, including before the potential costs and benefits were known. The majority (59 per cent) said they would increase the rent. The next largest group (21 per cent) said they would remove the property from the market and sell it — to either another rental provider or to an owner-occupier. About 16 per cent said that nothing would change under the proposed minimum standards. A further 5 per cent said they would redevelop the property or another option (see Figure 5.14).

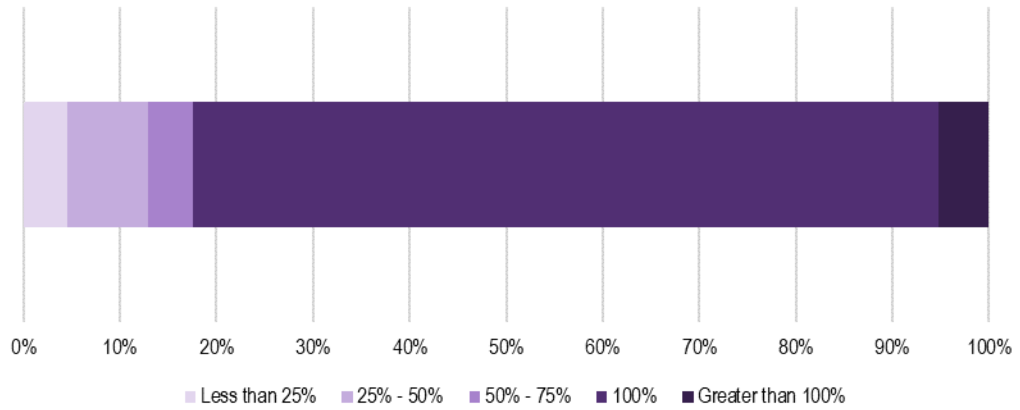
Figure 5.14 Reported response of rental providers



Source: ACIL Allen

Of those who said they would increase rents, the majority (77 per cent) said they would pass through the additional cost in whole. About 17 per cent would increase rents by less than the additional costs, effectively sharing the costs with tenants. Five per cent said they would increase rents greater than the costs of any required upgrades (see Figure 5.15).

Figure 5.15 Rental passthrough for rental properties



Source: ACIL Allen

Interaction with existing regulation

Stakeholders consulted highlighted that the *Residential Tenancies Amendment Act* (2019) would inhibit the capacity for rental providers to readily pass-through costs to tenants (see section E.4). The current rental laws limit the capacity for rental providers to increase rents above a consumer price index-based formula. The laws were acknowledged as difficult to navigate and hard to interpret — for rental providers and tenants alike.

The changes under the *Residential Tenancies Amendment Act (2019),* however, will not prevent rent increases on existing leases above a prescribed rate, which is linked to the Consumer Price Index. While rent cannot be increased above the prescribed rate during the term of an agreement, rental providers can apply to the ACT Civil and Administrative Tribunal (ACAT) for rent increases above the prescribed amount at the end of a twelve-month period for existing leases. Under the

Residential Tenancies ACT (1997), ACAT can recognise “outgoings”, “the value of fixtures and goods supplied by the lessor as part of the tenancy” and “the value of any work performed or improvements” in rental properties in approving excessive rent increases.

For new rental agreements, rental providers can propose any rent they like, so long as tenants agree. If many — if not most — of the upgrades will be triggered by new rental agreements during the phase-in period, the provision limiting rent increases in the *Residential Tenancies Amendment Act (2019)* will not apply.

Groups representing rental providers indicated that changes to taxation have also impacted returns to rental properties in recent years. Though the interaction with tax conditions is general. It will vary considerably amongst rental providers based on their own circumstances and are partly addressed above.

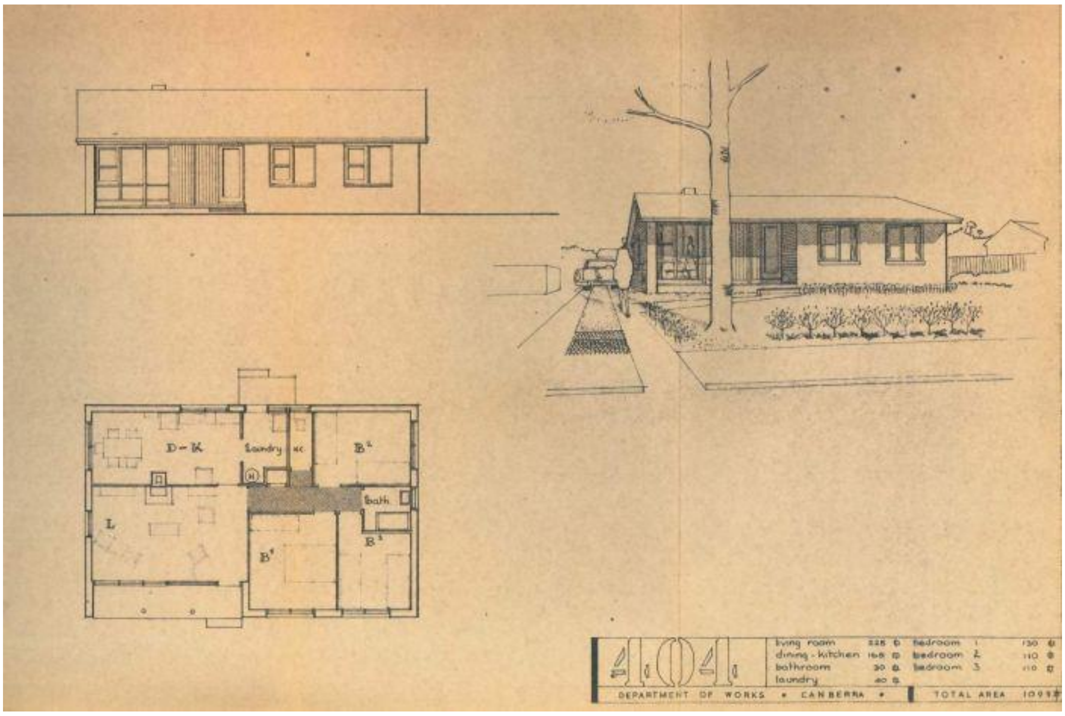
Impacts on the rental market

The impacts on the rental market from the proposed standards are an important consideration. Canberra has vacancy rates of 0.9 per cent, the lowest of any capital city (CMTEDD, 2021). Tenants who responded to ACIL Allen’s survey indicated how difficult it can be to find rental properties. 50 per cent of respondents said it would be impossible to find an equivalent rental property to their current dwelling within their budget, a further 38.5 per cent thought it would be difficult. Only 11.5 per cent of respondents thought it would be possible to find an equivalent rental property.

The full extent of the impacts on the rental market is beyond the scope of this report. However, the analysis of rental returns, above, as well as the survey results suggest that the proposed standards will not drive the majority of rental providers to withdraw their property from the rental market.

While some rental providers may choose to sell their rental property to an investor who would prefer lower returns with less risk, other rental providers may sell their property to a new owner-occupier which may or may also relieve demand on the rental market. A portion of rental providers may demolish an existing low energy-efficiency rental property (for example, an ex-government 400 series house in Canberra’s older suburbs — illustrated in Figure 5.16) and replace it with several new energy-efficient properties.

Figure 5.16 400 series "ex-govie" properties common in Canberra's older suburbs



Source: ArchivesACT via (Gee, 2017)

In any case, there is no obvious impact pathway which would lead to a smaller housing stock in total (supply) in the ACT, especially in the rental market — though the proposed standards could conceivably increase demand or increase rent (price) as a result of creating rental properties which provide more benefits to tenants.

The proposed standards may have implications for the rental market beyond those properties which are forced to upgrade. Energy-efficiency and thermal control is a desirable element of rental properties. Accordingly, it can attract a premium in the market — tenants may be willing to pay more for an energy efficient property. As lower energy-efficient properties are improved, it may decrease this premium somewhat. Accordingly, some of the rent increases for those upgraded properties will be partially offset by rent decreases in other properties over the long-term.

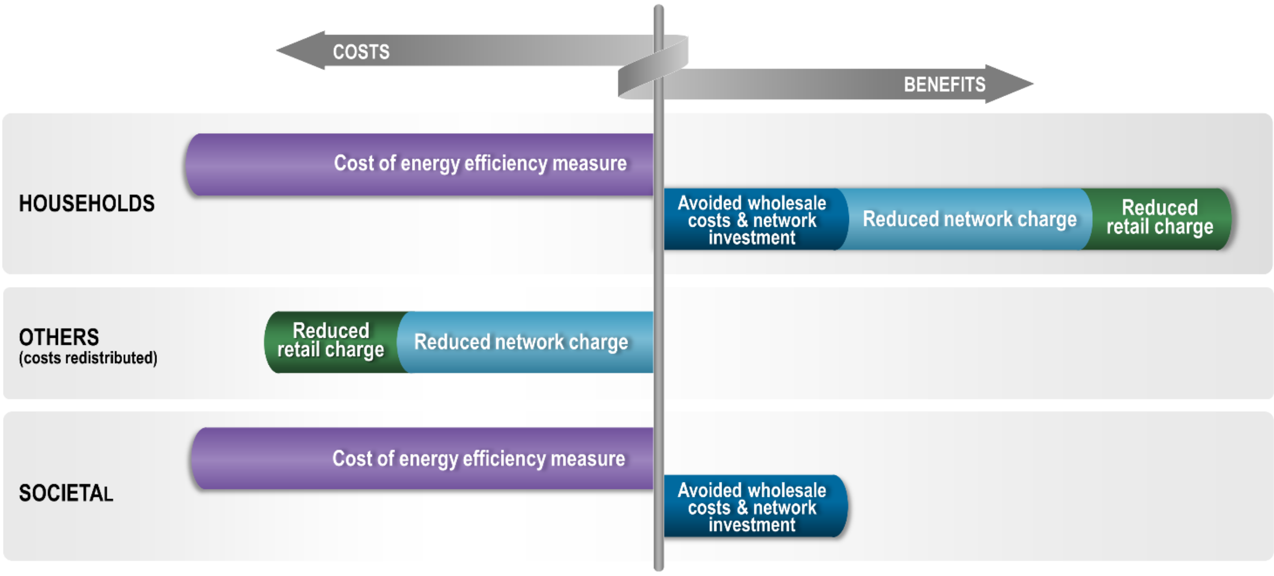
More research would be required to properly analyse and predict impacts on the ACT's rental market.

5.2.4 Understanding distributional impacts

It may appear odd that some of the minimum standards are positive at a household level but may be negative at the economy-wide level. It would seem natural that, if the sum of benefits is positive for tenants — and possibly neutral for rental providers — that the options should be positive for society overall.

However, in these cases the value of energy savings for tenants is greater than the resource savings to society overall. Fixed network costs and energy retail costs still need to be recovered by energy retailers. Thereby, a large part of the tenants' benefit is a result of a transfer between individuals — from society as a whole to tenants. Similarly, tax deductions for rental providers, which help ameliorate upgrade costs, are exactly offset by tax losses to the rest of society. This is illustrated in Figure 5.17.

Figure 5.17 Redistribution of costs and benefits



Note: The scale of impacts are illustrative only.
Source: ACIL Allen

The energy charges that are reduced for tenants, but which do not result in costs being avoided, are transferred to other energy users — even those who have nothing to do with the minimum standards — through higher energy prices. The benefit to tenants is exactly offset by increased costs elsewhere. This type of transfer is called a pecuniary externality. In modelling the net impacts, this transfer at an economy-wide level is accounted for by using wholesale energy prices and avoided network costs (as a proxy for avoided resource costs), which is why it is used in this CBA.

While it is true that tenants can be made better off, and rental providers can be left no worse off, this is because a large part of this benefit is transferred to the rest of society. Because the impact analysis has to consider all net impacts, including these transfers, at the society level, a large part of the benefit to tenants must be offset in headline net present value results when assessing the policy overall.

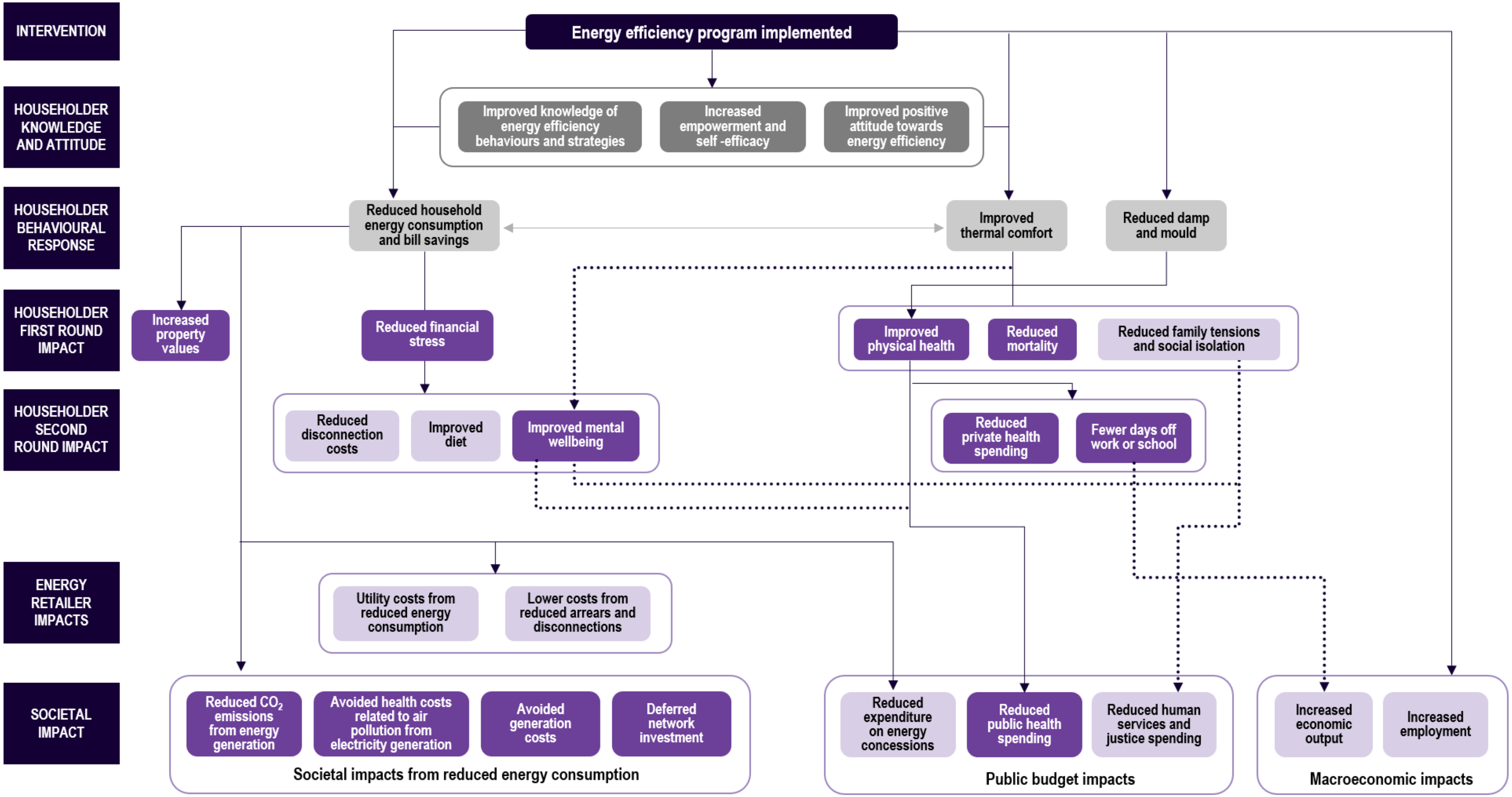
5.3 Non-measurable benefits

As noted above, in addition to the impacts quantified in the CBA of the proposed minimum standards, there are a number of other impacts (both costs and benefits) associated with energy efficiency – both private and public that cannot be quantified due to a lack of existing estimates for the Australian context. These multiple impacts were mapped in our report *Assessment Framework for the Multiple Impacts of Household Energy Efficiency* (2017) (see Figure 5.18) and include the impacts of energy efficiency on:

— health[7] and wellbeing
— the energy system
— the overall economy
— other participant benefits.

[7] As noted in section 5.1.1, health benefits are partially modelled and are sensitivity tested, below.

Figure 5.18 Energy efficiency impacts logic map



Note: impacts presented in a darker shade are, to date, underpinned by a more substantial evidence base than those in a lighter shade.
Source: ACIL Allen

These benefits are briefly discussed in the sections below.

5.3.1 Health and wellbeing

Residential energy efficiency actions can result in a number of health-related impacts in addition to the direct observable energy savings. Health and wellbeing impacts can materialise through three main pathways:

1. Improved thermal quality – which reduces mortality from hot and cold extremes, as well as symptoms of a range of diseases such as respiratory and cardiovascular diseases, allergies, arthritis and rheumatism. Alleviation of chronic thermal discomfort can also contribute to improved mental wellbeing. Other indirect impacts (or co-benefits) of thermal quality that have been suggested in the literature, but are not yet well-established (IEA, 2015) include:
   - lessened family tensions if installation of energy efficiency measures allows more areas of the dwelling to be heated, lessening the need for the family to crowd into a single heated room
   - reduced social isolation if energy efficiency measures reduce occupants' embarrassment with their uncomfortable conditions
   - improved social cohesion and sense of community among residents
   - higher rates of school attendance
   - healthier lifestyles
   - improved access to local services.
2. Improved indoor air quality and reduced dampness – which can lead to improved physical health, and reduced mortality and morbidity.
3. Reduced household energy consumption and bill savings – as noted above, reduced spending on energy as a result of an energy efficiency intervention can lead to reduced financial stress among households experiencing energy bill pressure. This in turn can have other positive indirect effects, including:
   - reduced disconnection costs
   - improved mental wellbeing — energy efficiency may lead to improved mental health and wellbeing outcomes through reducing financial stress related to high energy bills and fear of falling in debt
   - reduced malnutrition and obesity if funds freed up from lower energy bills are used to purchase better quality food.

   As noted in section 5.1.1, these potential benefits are only partially modelled.

5.3.2 Energy system

As noted in our 2017 report (ACIL Allen, 2017), energy efficiency interventions can lead to tangible benefits along the entire energy supply chain, if this consideration is taken into account during the design stage. The benefits for energy providers include (Lazar & Coburn, 2013) (IEA, 2015):

- improved system reliability
- enhanced capacity adequacy
- better ability to manage peak demand
- opportunities to defer generation and network infrastructure investments (avoided transmission and distribution investments related to the scheme are quantified in this CBA)
- reduced price volatility in wholesale markets.

Additional benefits specific to programs targeting low income or vulnerable customers (in this case, households in public housing) include improved ability to manage energy bills, which in turn can lead to reduced arrears, unpaid debts and collection costs for energy utilities. To the extent to which these costs are borne by the utilities, the savings can (in a competitive market) be assumed to ultimately accrue to non-participants in the form of lower utility bills. If hardship or payment assistance programs are funded from general tax revenue, cost savings can be regarded as societal benefits (Lazar & Coburn, 2013).

5.3.3 Overall economy

There are two potential impacts of energy efficiency interventions on the overall economy:

- Public budget impacts — energy efficiency interventions can reduce public spending through:
  - reduced expenditure on energy concessions (if households receiving energy concessions reduce their energy consumption)
  - reductions in public health spending due to the health impacts discussed above
  - reduced demand on human services and the justice system due to improved mental wellbeing and reduced family tensions.
- Macroeconomic impacts — the macroeconomic impacts of energy efficiency cover effects occurring at national, international and regional levels. Energy efficiency may result in changes in the overall economy through two main sources of impact:
  - investment effects which arise from increased expenditure on energy efficient goods and services, which leads to higher production in these sectors but lower production in other sectors of the economy
  - energy demand reduction effects that operate through reduction (cost savings) in relation to energy-related expenditure leading to increased disposable income and higher business profits.

These two effects combined can lead to changes in macroeconomic variables such as Gross Domestic Product (GDP), employment, energy prices and the trade balance (IEA, 2015).

5.3.4 Other participant benefits

As noted by ACIL Allen (2017) a number of other impacts linked to energy efficiency have been hypothesised, but not yet robustly measured. These include the following (Kenington, Wood, Reid, & Klein, 2016) (GEER Australia, 2017).

- *Self-efficacy (or empowerment):* refers to the ability of individuals to control the use of energy in the home and the empowerment that arises through understanding how energy works, through the use of knowledge, technology or seeking the right assistance. Self-efficacy is also related to confidence to take action and control one’s life which is closely linked to wellbeing and to resilience.
- *Community engagement:* refers to the extent to which people are connected to their local community or area, through formal or informal links, and the extent to which they participate in or feel connected to the life of their community. The impact may be present for energy efficiency programs with a community focus.
- *Support for vulnerable people:* refers to the extent to which people are aware of and able to access social support options available to them. An energy efficiency program incorporating information on the broader range of available support options may improve participants’ ability to access support and address problems.
- *Level and quality of partnership:* refers to the effectiveness of partnerships emerging from or supported by an energy efficiency program. An energy efficiency intervention may bring together different stakeholder groups, which, as a result, may form partnerships lasting past program completion.

— *New business opportunities:* this impact refers to the extent to which energy efficiency programs can create additional business opportunities through demand for additional energy efficiency and renewable energy.

5.4 Sensitivity analysis

Several key variables are highly significant for the overall results. We have conducted sensitivity analysis for:

— the discount rate

— energy prices

— climate impacts

— the balance between energy efficiency and health impacts

— upgrade costs

— maximum expenditure limits (discussed briefly).

Key variables have been tested to explore their importance to the results and provide insights regarding outcomes based on alternative prices or scenarios in future.

5.4.1 Discount rate

The discount rate is a common rate, which is used to help compare future impacts with present or past impacts. It is important to compare all scenarios with the same discount rate. Different discount rates can change the results, particularly for scenarios which run over different lengths of time.

A lower discount rate favours measures with longer-term benefits — namely ceiling insulation, which has an assumed lifespan of 25 years. A higher discount rate favours measures with shorter-term benefits — namely energy efficient heaters, which have an assumed lifespan of 12 years. A discussion of the discount rate and the choice to use a three per cent discount rate is given in appendix B.3.2.

Two commonly used discount rates are seven per cent and ten per cent. The net present value for each of these (and the three per cent reference case) is given in Table 5.6.

It is important to note that 2-star performance standard options become the preferred option at the 10 per cent discount rate.

Table 5.6 Net present value at various discount rates

Heading	NPV - 3% reference discount rate ($ million)	NPV - 7% discount rate ($ million)	NPV - 10% discount rate ($ million)
a) Insulation R3 - 2 year	$10.44	-$7.01	-$14.20
b) Insulation R3 - 4 year	$11.08	-$6.23	-$13.30
c) Insulation R5 - 2 year	$17.42	-$4.45	-$13.51
d) Insulation R5 - 4 year	$18.01	-$3.71	-$12.62
e) Heater - 2 year	-$15.56	-$16.83	-$17.31
f) Heater - 4 year	-$15.56	-$16.62	-$16.96
g) Performance 2-stars - 2 year	-$12.95	-$12.90	-$12.86
h) Performance 2-stars - 4 year	-$12.76	-$12.71	-$12.61

Heading	NPV - 3% reference discount rate ($ million)	NPV - 7% discount rate ($ million)	NPV - 10% discount rate ($ million)
i) Performance 3-stars - 2 year	-$119.66	-$119.29	-$124.94
j) Performance 3-stars - 4 year	-$116.41	-$116.04	-$121.16

Note: All scenarios are presented with a social cost of carbon calculated at 3 per cent discount rate. A sensitivity test of the social cost of carbon is presented separately.
Source: ACIL Allen

5.4.2 Energy prices

Energy prices are an important determinant of benefits and therefore results. Using wholesale energy prices as a proxy for avoided resource costs, many of the options impose a net cost to the ACT community. However, at the household level all options are NPV-positive based on retail energy prices — which are typically between three and five times higher than wholesale prices.

This analysis for energy prices aims to answer the question 'how much would the wholesale energy prices have to increase for a minimum standards policy to break even to society in cost-benefit terms?' To answer this question a scalar for wholesale energy prices was used to find the net present value at various energy price increases (at a three per cent discount rate). The results are presented in Table 5.7 and show that the wholesale energy prices would need to be:

— about 1.95 times higher for heater options to become net positive for society
— about 2.5 times higher for 3-star performance options to become net positive for society
— about 2.7 times higher for 2-star performance options to become net positive for society.

All these increases in energy prices do not change the ordinal ranking of the options, though do make a two-year phase in a preferred option at higher energy prices.

Table 5.7 Energy prices sensitivity testing

Scenario	NPV ($ million) – energy prices 96% higher	NPV ($ million) – energy prices 152% higher	NPV ($ million) – energy prices 172% higher
a) Insulation R3 - 2 year	$52.92	$77.68	$86.53
b) Insulation R3 - 4 year	$53.19	$77.75	$86.52
c) Insulation R5 - 2 year	$69.00	$99.07	$109.81
d) Insulation R5 - 4 year	$69.14	$98.96	$109.61
e) Heater - 2 year	$0.31	$9.54	$12.84
f) Heater - 4 year	$0.12	$9.24	$12.49
g) Performance 2-stars - 2 year	-$5.72	-$1.49	$0.02
h) Performance 2-stars - 4 year	-$5.52	-$1.25	$0.28
i) Performance 3-stars - 2 year	-$39.02	$0.33	$14.38
j) Performance 3-stars - 4 year	-$35.22	$4.66	$18.90

Note: All scenarios are presented with a social cost of carbon calculated at 3 per cent discount rate.
Source: ACIL Allen

5.4.3 Climate change

The future impacts of climate change are still subject to human responses and a great deal of uncertainty. However, recent research — such as the Intergovernmental Panel on Climate Change's *Sixth Assessment Report* (IPCC, 2021) — has highlighted that the effects are becoming more clear and are likely to be worse than previously expected. As discussed in B.1.1, the way these impacts are accounted for can result in different social costs of carbon.

Table 5.8 shows the impact on the net present value of a:

— 5 per cent social cost of carbon based on average impacts with 5 per cent discount rate

— 3 per cent social cost of carbon based on average impacts (reference case) with 3 per cent discount rate

— 'high impact' 3 per cent social cost of carbon based on the 95th percentile of impacts with 3 per cent discount rate.

None of the alternative social costs of carbon change the ordinal ranking of the options.

Table 5.8 Carbon price sensitivity testing

Scenario	NPV - 5 per cent social cost of carbon / 5 per cent discount rate ($ million)	NPV - 3 per cent SSC reference case / 3 per cent discount rate ($ million)	NPV – high impact 3 per cent SSC / 3 per cent discount rate ($ million)
a) Insulation R3 - 2 year	-$8.00	$10.44	$51.27
b) Insulation R3 - 4 year	-$7.24	$11.08	$51.81
c) Insulation R5 - 2 year	-$5.40	$17.42	$67.16
d) Insulation R5 - 4 year	-$4.66	$18.01	$67.63
e) Heater - 2 year	-$19.02	-$15.56	-$3.33
f) Heater - 4 year	-$18.89	-$15.56	-$3.33
g) Performance 2-stars - 2 year	-$14.45	-$12.95	-$7.79
h) Performance 2-stars - 4 year	-$14.32	-$12.76	-$7.57
i) Performance 3-stars - 2 year	-$128.46	-$119.66	-$53.71
j) Performance 3-stars - 4 year	-$125.55	-$116.41	-$49.84

Source: ACIL Allen

5.4.4 Health impacts vs energy-efficiency savings

The health impacts versus energy-efficiency savings are discussed in section 5.1.1. The trade-off is highly complex, and not easily quantified. In the reference case scenarios, the only health impacts quantified are from particulates from domestic gas burning.

There is uncertainty regarding the health benefits of improved thermal comfort, household preferences (the degree to which they prefer improved thermal comfort and the degree to which they value energy cost savings), and the marginal rate of technical substitution for each household.[8] That is:

— It is unknown how well rental properties can trade-off thermal comfort for energy savings. It is even more complicated given behavioural choices.
— It is unknown how the trade-off varies between rental properties.
— It is unknown how extensive health benefits would be if tenants were to take all benefits as health and comfort, rather than as energy savings.
— It is unknown how tenants preference uncertain health benefits relative to readily realisable energy savings.

Accordingly, weighting health benefits highly relative to energy-savings introduces many unknowns and uncertainties.

To test the scenario where all benefits are taken as improved health outcomes, estimates based on the New Zealand Heat Smart Programme (Grimes, Denne, & Howden-Chapman, 2012) have been used (see Appendix B). In this case, energy use remains the same — the rebound effect is 100 per cent — that is, there are no carbon offsets, network savings, energy savings, or renewable energy offsets avoided. This replaces one benefit (health) for six others, including one type of health benefit for two others. The result is shown in Table 5.9.

Table 5.9 Headline results, health impacts only

Option modelled	Benefit-cost ratio (BCR)	Net present value ($ million)
a) Insulation R3 - 2 year	0.14	-$46.57
b) Insulation R3 - 4 year	0.14	-$45.52
c) Insulation R5 - 2 year	0.12	-$53.45
d) Insulation R5 - 4 year	0.13	-$52.35
e) Heater - 2 year	0.10	-$34.15
f) Heater - 4 year	0.10	-$33.94
g) Performance 2-stars - 2 year	0.04	-$23.02
h) Performance 2-stars - 4 year	0.04	-$23.05
i) Performance 3-stars - 2 year	0.04	-$202.94
j) Performance 3-stars - 4 year	0.04	-$201.48

Note: All scenarios are presented with a social cost of carbon calculated at 3 per cent discount rate.
Source: ACIL Allen

Sensitivity testing of health impacts involves two changes. The first is to substitute all energy cost savings for health benefits, the second is to test the breakeven point for health benefits. Given the uncertainties discussed above, the results are highly speculative (that is, the feasibility of the two constraints is highly uncertain). The sensitivity testing is given in Table 5.10. The results can be interpreted as 'if all the household energy savings are received as health benefits (i.e. no energy efficiency savings), health benefits would have to be X per cent higher than estimated in the central case'. So, for instance, for the R3 insulation options to break even for society, the health benefits would have to be six times larger than we estimate them to be when households receive all energy benefits as health benefits (i.e. when energy bill savings are zero).

[8] This is further complicated by reflecting heterogeneous rates of technical-substitution (reflecting variable conditions in rental properties), uncertainty regarding the realisable health benefits of improved thermal comfort due to human behaviours, consumer preference over health-promoting consumption (with associated behavioural issues, such as 'irrational discounting' of health benefits).

Table 5.10 Breakeven point for health benefits

Scenario	Breakeven point for health benefits – increase relative to assumed health benefits with no energy savings
a) Insulation R3 - 2 year	615%
b) Insulation R3 - 4 year	605%
c) Insulation R5 - 2 year	705%
d) Insulation R5 - 4 year	696%
e) Heater - 2 year	932%
f) Heater - 4 year	935%
g) Performance 2-stars - 2 year	2149%
h) Performance 2-stars - 4 year	2153%
i) Performance 3-stars - 2 year	2569%
j) Performance 3-stars - 4 year	2560%

Note: All scenarios are presented with a social cost of carbon calculated at 3 per cent discount rate.
Source: ACIL Allen

Given the degree of uncertainty, these scenarios are highly speculative. The above results are intended to illustrate both how uncertain health benefits are, and how speculative the health benefits would have to be to make the proposed options preferred rather than dis-preferred without energy savings (in contrast to public health measures which are far more certain). Though, as noted, the benefits should be understood as a lower bound estimate.

5.4.5 Upgrade costs

The breakeven analysis for upgrade costs aims to answer the question ‘how much would the costs of upgrades have to decrease for a minimum standards policy to break even to society in cost-benefit terms for all scenarios?’ To answer this question a scalar for upgrade costs was used to find the breakeven point for each scenario (where NPV is zero with a three per cent discount rate). The results are presented in **Table 5.11**. They show that the upgrade costs would need to be:

— about 46 per cent lower for heater options to become net positive for society
— about 52 per cent lower for 3-star performance options to become net positive for society
— about 77 per cent lower for 2-star performance options to become net positive for society.

All these decreases in upgrade costs do not change the ordinal ranking of the options.

Table 5.11 Breakeven point for upgrade costs

Sensitivity testing of upgrade costs Scenario	NPV ($ million) – upgrade costs 47% lower	NPV ($ million) – upgrade costs 152% lower	NPV ($ million) – upgrade costs 172% lower
a) Insulation R3 - 2 year	$22.11	$23.36	$29.56
b) Insulation R3 - 4 year	$22.67	$23.90	$30.07
c) Insulation R5 - 2 year	$32.69	$34.31	$42.43
d) Insulation R5 - 4 year	$33.17	$34.78	$42.84
e) Heater - 2 year	$0.40	$2.10	$10.59
f) Heater - 4 year	$0.26	$1.94	$10.35
g) Performance 2-stars - 2 year	-$4.98	-$4.12	$0.16

Sensitivity testing of upgrade costs Scenario	NPV ($ million) – upgrade costs 47% lower	NPV ($ million) – upgrade costs 152% lower	NPV ($ million) – upgrade costs 172% lower
h) Performance 2-stars - 4 year	-$4.94	-$4.09	$0.15
i) Performance 3-stars - 2 year	-$9.65	$0.71	$52.49
j) Performance 3-stars - 4 year	-$7.67	$2.59	$53.89

Note: All scenarios are presented with a social cost of carbon calculated at 3 per cent discount rate.

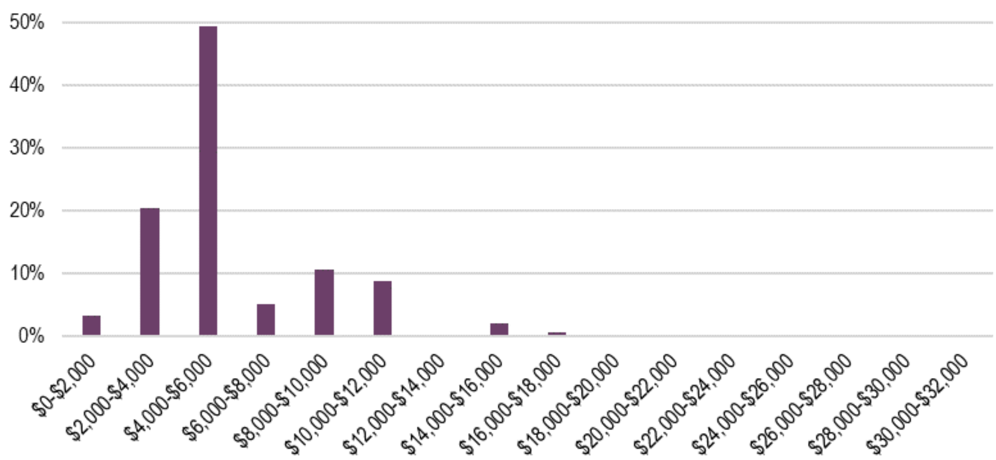
Source: ACIL Allen

5.4.6 Maximum expenditure limits

Upgrade costs for the performance standards are highly variable across the rental housing stock. The costs to reach a 2-star or 3-star performance standard are difficult to predict for an individual household. The central results have been estimated without maximum expenditure limits. Including maximum expenditure limits in the policy would mean that the worst performing rental properties would be limited in the degree to which they would have to make upgrades.

For a performance-based option, maximum expenditure limits could have a significant impact on the results from the analysis. The basis for the upgrade costs used in the modelling of the performance options are described in Appendix C. The distribution of assumed costs for upgrades to a 2-star performance standard are given in Figure 5.19.

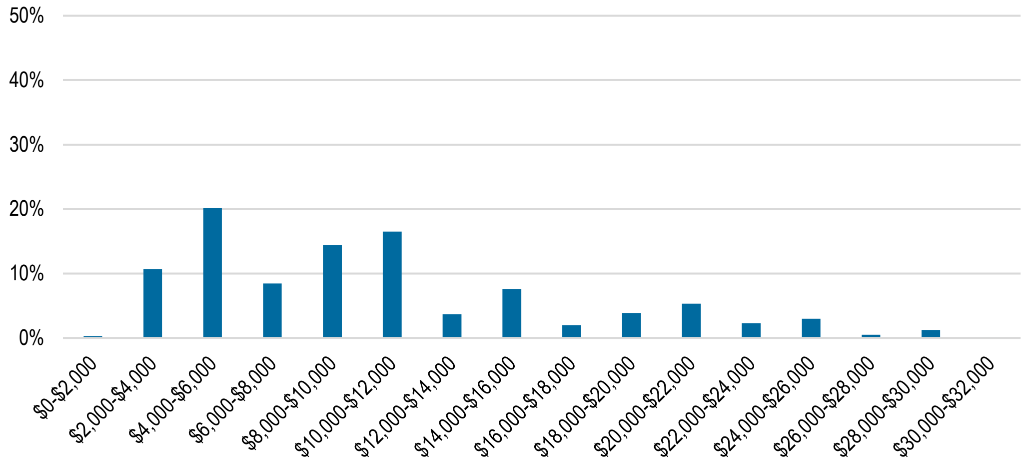
Figure 5.19 Distribution of costs to upgrade to 2 stars



Source: Energy Efficient Strategies

The assumed costs for a 3-star performance standard are given in Figure 5.20.

Figure 5.20 Distribution of costs to upgrade to 3 stars



Source: Energy Efficient Strategies

A maximum expenditure limit would likely decrease up-front capital costs of the performance options but will also decrease their associated benefits. The effect of a maximum expenditure limit has not been modelled. However, a limit has the potential to ameliorate the impacts on rental providers (particularly those with the worst-performing properties).

Implementation and review 6

This chapter provides guidelines for the implementation and review of minimum energy efficiency standards for residential rental properties. It covers an approach to administration and enforcement of minimum standards, including considerations noted by stakeholders. It discusses potential supporting mechanisms (not included in the impact analysis or core options). Finally, it provides a roadmap for review of the programs.

The recommendations in this section generally apply equally to all options presented. In several cases, the recommendations pertain only to a performance option, and are indicated as such.

6.1 Administration and enforcement

The implementation of the proposed standards will be a cross-agency responsibility. Elements of the implementation and the responsible parties include:

— Providing legislative drafting and supporting materials, which will be the responsibility of the Directorate. Supporting measures described in section 6.2 would also be the responsibility of the Directorate.

— Enforcement and compliance, which may be the responsibility of Access Canberra, which already provides information, services and compliance mechanisms in related areas.

— Housing ACT, which will have the responsibility to assess and manage its public housing stock and make upgrades as appropriate.

6.1.1 Compliance and enforcement mechanisms

Compliance is the responsibility of rental providers. In some cases, property managers may be able to inform and support rental providers to meet their obligations under a minimum standard for rental properties. Stakeholders asserted that property managers should not be assumed to be primarily responsible for meeting the standards. They were of the view that informing, educating and supporting rental providers should be the responsibility of government.

Compliance triggers

Compliance could be required for all rental properties at the start of a new lease, or at the end of the phase-in period, whichever comes first (this was the assumption modelled). Alternatively, compliance could just be required by the end of the phase-in period. Rental providers can readily ascertain for themselves whether a heater is required or through an assessment in the case of whether an insulation upgrade is required.

Under a performance standard, rental providers will need an assessment using the scorecard type measure.

Exemptions

Meeting the minimum standards will not be possible for all rental properties, particularly for insulation or heating standards. Technical limitations will need to be recognised in the regulations. Stakeholders acknowledged that for rental providers to be exempted from the minimum standards, they should have to provide proof — preferably from a professional.

Additional reasons for valid exemptions have been identified in policies in other jurisdictions (see Appendix A). Examples include:

— conservation value
— heritage value
— maximum spending limits (see section 5.4.6)
— tenants withholding consent for upgrades to be made
— where substantial devaluation of the property is likely
— risks to the structure
— multi-unit properties, where upgrades could infringe on the rights of other residents
— where the property was previously owned by the tenant (sale and rent-back arrangements)
— where a rental property is likely to be substantially demolished or redeveloped
— certified passive buildings
— semi-permanent or business-based rental properties such as boarding houses and hotels
— properties not rented through winter.

Enforcement

Extensive enforcement of the minimum standards on all rental properties at all times would become burdensome and not practical. A risk-based approach to compliance testing has been used in New Zealand to maximise the government's effectiveness at ensuring compliance. A small number of inspections are made each year, focused on those rental properties which are most likely to be non-compliant. Cases of non-compliance are then publicised. The ACT could adopt a similar approach, checking compliance on a targeted subset of rental properties.

Tenants will need to be able to report non-compliance in such a way that they are not then subject to any form of retaliation. Tenant groups consulted identified that fear of retaliation is a real barrier to reporting faults in rental properties.

6.2 Supporting mechanisms

Stakeholders identified that a holistic policy would result in better outcomes when assessed against the policy objectives. Three additional support mechanisms were commonly proposed:

— supporting educational initiatives
— government subsidy
— draught proofing.

6.2.1 Education and information

One stakeholder suggested that the energy-efficiency of a rental property is two-thirds related to the physical condition of the property, while one-third relates to how the property is used. Several stakeholders indicated that there was room for supporting information for tenants. However, as acknowledged in section 4.1.1, the ACT Government already provides a number of supporting information and education programs, including some aimed at tenants.

6.2.2 Government subsidy

Even with full cost pass-through, the upfront capital costs for rental providers can be significant. Under the performance options, a minority could have costs in excess of $28,000, based on the modelling. Even under a feature-based standard, expenses are expected to be in the thousands of dollars. While some of this can be recovered through increased rents, some rental providers will struggle to meet the costs.

Groups representing rental providers were strongly of the opinion that government subsidies would be required to prevent some rental providers from exiting the market — that is, selling the property rather than making the investments required to meet the minimum standards.

A government subsidy for upgrades, that is delivered on condition that the upgrade costs are not passed on immediately to renters, would reduce the risk of the regulations resulting in immediate rental increases across the ACT and should be considered for this reason.

6.2.3 Draught proofing complementary to a features-based standard

There is a clear relationship between insulation and draught sealing on the thermal comfort of a home. As identified by the Energy Efficiency Council and the Australian Sustainable Built Environment Council:

> *Insulating materials play a key function in maintaining a safe and comfortable indoor temperature, but can also influence air movement, air quality, moisture and the presence and absence of mould.*
>
> *(Energy Efficiency Council and Australian Sustainable Built Environment Council, 2021)*

The thermal performance of a building is also impacted by air leakage. Although excessive air tightness can result in poor air quality, including high levels of carbon dioxide, standard draught proofing of older housing stock in the ACT is unlikely to result in excessive air tightness. Modern building practices combine minimising unintended air leaks with designing effective ventilation systems to ensure an appropriate level of airflow through a building. Ventilation strategies also have a critical impact on moisture level.

Some stakeholders from industry and representing community groups pointed out that the benefits of insulation and heating are limited by poor draught proofing. Some stakeholders put forward that draught-proofing would be a more cost-effective improvement for some households. It was suggested that draught proofing should be promoted as a complement to the feature standards.

6.3 Implementation considerations

The following points are considerations for the implementation of a minimum standard.

6.3.1 General risks associated with installing ceiling insulation

As evidenced by the Commonwealth Government's Home Insulation Program, there are a range of risks associated with the installation of ceiling insulation in ACT homes. The most significant (extreme) risks include:

— Electrical hazards – the risks are death, fire, electric shock or other injury caused directly or indirectly by electricity. Some common electrical risks and causes of injury are electric shock; contact with services; electrocution; burns, particularly with PV installs; fire; wiring encapsulation; PV installs and DC cables.

— Working at heights – falls from height can result in permanent or debilitating injuries or deaths. This increases significantly when working at heights over two metres. The person installing ceiling insulation is exposed to falling from a ladder or scaffold, or falling through ceiling spaces.

— Inadequate training and low level of competency – to perform an installation safely, and to appropriate standards, requires training / knowledge and relies on the competency of installers or quality of installation.

Other risks include exposure to the use of inappropriate materials, inadequate design and documentation, improper manual handling, hazardous substances, working in confined and/ or restricted spaces, and condensation.

The risks associated with installing ceiling insulation in existing buildings are greater than in new buildings due to uncertainty around pre-existing conditions such as wiring and electrical equipment, accessibility and exposure to hazardous substances (vermin and asbestos). The risks can be exacerbated when a householder elects to self-install.

There are a number of measures to mitigate these risks including a pre-inspection of the site, mandatory installation industry training program, a requirement to comply with a range of standards, an audit program, and adequate ventilation to mitigate the build-up of condensation.

The Energy Efficiency Council and Australian Sustainable Built Environment Council (2021) identified that the insulation needs to be correctly installed to maximise benefits and reduce risks for building occupants, including minimising unnecessary gaps in the coverage of insulation, leaving space around heat-generating equipment (for example, heating fans and downlights). They developed a number of recommendations that would improve the safety and quality of insulation installations. The intent was for these recommendations to form the basis for a roadmap. The recommendations include:

— training and accreditation
  — insulation installers should undergo basic training relating to the safe and effective installation of insulation before they undertake any installation work
  — develop a competency-based 'Insulation Professional' certification
  — integrate basic information on insulation in the training and Continued Professional Development of selected trades
— installation of insulation in building retrofits
  — develop national guidelines and documents for insulation retrofits
  — maintain a list of products that have been verified to meet the current version of the relevant Australian Standard[9]
  — public programs to require the use of quality installers, processes and products, and the use of companies that are pre-approved to install insulation
  — commission independent audits of insulation installations completed under government programs
— moving beyond an insulation-only approach
  — maximise the benefits of insulation by integrating the installation of insulation with other elements of a building's thermal envelope, air tightness and ventilation systems.

Top up or replacement of poor insulation

One of the issues for consideration in prescribing a higher minimum standard of insulation for existing homes that are poorly insulated is whether the insulation should be topped up or replaced. The costs are higher if existing insulation is removed rather than installing new insulation on top of

[9] AS/NZS 4859.1 Materials for the thermal insulation of buildings.

existing insulation. This may require the development of clear guidelines for installers and householders to help ensure that existing insulation is only removed where necessary.

Insulation Australasia noted that insulation installers would prefer to replace installation rather than top up existing insulation as the cost of installation and margin was higher. However, tops ups are only suitable if the insulation is in reasonable condition. Insulation Australasia considered that a top up was not appropriate in circumstances where there is a rodent infestation, or where fibreglass batts would be placed over cellulose as it would increase the chance of a fire.

The Insulation Council of Australia New Zealand also raised the fire risk associated with top ups, particularly if any wiring is on top of the original insulation. If new insulation is then placed on top of the original insulation, there is a risk of the wiring overheating. There is also a potential risk with the clearance around downlights.

The Insulation Council of Australia New Zealand was also of the view that the risks associated with top ups are greater if the original insulation is cellulose. The cellulose can be combustible, tends to move over time and creates a hazard as the installer cannot see where to walk in the ceiling.

6.3.2 Availability of a performance rating tool

A performance-based standard requires the availability of a low-cost whole-of-house performance rating tool. The Victorian Scorecard is an example of this kind of performance rating tool. The two tools currently used in the ACT (ACTHERS and NatHERS) are not suitable for this purpose. The ACT Government will need a suitable performance rating tool in place prior to implementing a performance-based standard.

Additionally, trained assessors will be required to provide assessments and advice to rental providers. The analysis, above, assumes that a sufficient number will be trained to provide the assessments in the early years of the phase-in. However, it is unlikely that the market will support this number over the longer-term — especially as elements of the standards are no longer supported — which may inhibit those that invest in training and up-skilling, and therefore the availability of assessors when they are needed.

Presence of multiple performance standards

Multiple stakeholders complained about the confusion and difficulty surrounding the existence of multiple performance rating tools (NatHERS and ACTHERS). Adding another performance rating tool would add to this confusion, and the degree to which a rating can be convertible is questionable. Transitioning away from ACTHERS would address this issue — however, some provision would need to be made for those rental providers who have a rating other than the scorecard.

6.3.3 Public housing

The burden of a minimum standard for rental properties will be particularly significant for the public housing sector generally. Several specific factors which apply to this sector include:

— Expense – While the ACT Government has some policies aimed at providing energy efficiency upgrades in public housing, the funding currently available is insufficient to meet the proposed minimum standard in all houses. Budget constraints are generally the major limitation for the public sector in making upgrades to their properties.

— Audit of housing – A primary hurdle in applying a minimum standard to rental premises is an assessment of the condition of the properties. Undertaking an audit of the existing rental stock to identify the status of various energy efficiency characteristics of the dwellings would come at a substantial additional cost.

- Vulnerable and diverse renters – Public housing caters for particularly vulnerable populations with diverse needs. Tenant consent and participation is a necessary part of any upgrades. Many public housing tenants may have trouble navigating the process of their tenancy being upgraded to meet minimum standards. These groups may need support in facilitating upgrades of thermal comfort features.
- Upgrade phase-ins – Unlike private rental leases, public housing tenants tend to stay for significantly longer periods. Accordingly, we have assumed for the purpose of modelling that upgrades are made equally in each year of the phase-in period. In addition to the capital costs of the upgrades, Housing ACT will be required to employ additional staff to manage the upgrade program.

6.3.4 Phase-in periods

The phase-in periods are important for helping transition the rental market to the minimum standard. Stakeholders affirmed that they would be necessary to allow rental providers the time to make upgrades. The phase-in periods in the scenarios we modelled act like a final point after which the upgrades have to be made, however if rental providers need to undertake upgrades at the start of a new lease, many will have to make the upgrades in the first year, unless they renew existing leases, as a high proportion of leases are signed on an annual basis.

The results suggest that the difference between a two- and four-year phase-in period is marginal. However, if a large number of rental providers are required to meet a three-star performance standard, in only two years, there will be significant pressure on some parts of industry to deliver. This has the potential to lead to poor compliance, inefficiencies, and place upward pressure on the costs to upgrade.

Extending the phase-in periods and allowing rental providers to make the upgrade at any point during the phase-in will further assist rental providers, at the cost of tenants.

6.4 Review strategy

Good implementation will require ongoing monitoring and review after a sensible period. The modelling assumes that the majority of the upgrades will occur early on in the phase-in period, and that by the end of the ten-year period modelled they are substantially completed. After the end of the initial upgrades only a few properties, entering the rental market for the first time, will need upgrading. This presents a natural period of initial upgrading, then a period of less intense monitoring, and ultimately review. The Directorate should monitor non-compliance — possibly through Access Canberra and/or ACAT (as necessary).

There are no data sets which will allow for a complete comparison of rental property conditions before and after the minimum standards. However, under an appropriate Scorecard-like performance measure, some information would be generated on the state of rental properties prior to an upgrade as well as afterward. Housing ACT will be able to provide information on the change in condition for its own properties. For a features-based minimum standard, alternative evidence will need to be gathered, such as surveys of rental providers and tenants.

At the end of the ten-year period, the Directorate should complete a formal review of the minimum standard. It should ask:

- Is there still a problem?
- Are the objectives being met?
- Were the impacts as anticipated?
- Is action still required?

— Could more appropriate action be taken, i.e. implementation of a modified or different regulatory model? (CMTEDD, 2003)

Recommendation statement 7

As outlined in Chapter 5, the insulation options result in a net positive outcome economy-wide, while the heater and performance options come at a net cost economy-wide (see Table 5.1). The R5 insulation options, in particular, result in the highest net present value.

The option with the highest net positive impact in terms of energy costs and savings is the 3-star performance option. Though the R5 insulation options also perform well.

There are a number of other issues to consider alongside the results of the economy-wide CBA when assessing the way forward for the policy options considered in this RIS. These include:

— the distributional impacts on both tenants and rental providers
— the ease of regulatory burden and difficulty in implementation
— the views and preferences of the impacted parties.

In terms of impacts on individual households (distributional impacts), the policy option that would provide the highest potential net benefit to renters (despite potential full cost pass-through) would be the installation of R5 ceiling insulation with a two-year phase-in (*Option c* in Table 5.2). However, this is only marginally better than the four-year phase-in, and is a result of receiving the benefits marginally sooner for only a few households.

The insulation options are also relatively less expensive for rental providers, especially compared with the performance options. Expenses for rental providers, if they are unable to pass through costs, are in the order of $3 per week over the life of the asset, and only a fraction of a per cent of rental returns.[10]

The option with the strongest supporting evidence is the installation of R5 ceiling insulation with a four-year phase-in (*Option d*). Evidence supporting this include:

— The economy-wide benefits of *Option d* are the highest at the reference discount rate (three per cent). Furthermore, it remains the best option across comparison discount rates (see section 5.4.1).
— *Option d* remains the preferred option robustly across changes in many of the key drivers of costs and benefits (see section 5.4).
— Even if rental providers were to pass the cost of the upgrades in full to renters, the installation of R5 ceiling insulation would provide the highest potential net benefit to tenants over the life of the upgrade ($8,431 or $8,362 for a two- and four-year phase-in, respectively). With no cost pass-through, the net benefits to tenants are relatively high (but not the highest) against the other options and are the highest of the feature-based minimum standards (see Table 5.2).

[10] Based on hypothetical median rental property characteristics. Individual circumstances will vary and could be higher for some properties.

Without cost pass-through, the impacts on after-tax rental returns for the installation of R5 ceiling insulation are relatively small for both houses and units (see Table 5.4 and Table 5.5).

— It is relatively simpler for rental providers to comply with a feature-based minimum standard than a performance-based standard. It will require less time to organise, fewer inspections, and is relatively straightforward to make upgrades. Further, it requires no additional regulatory mechanisms — for example, it does not require the implementation and industry development to support a scorecard type performance measure (see section 6.3.2). This is not to say that this option is without risks (these are discussed in 6.3.1).

— The ceiling insulation option was the second-most preferred option for rental providers, tenants, and owner-occupiers — the option which generated the most consensus. Of rental providers who responded to our survey, 39 per cent agreed or strongly agreed with roof insulation; 90 per cent of tenants agreed or strongly agreed; and 62 per cent of owner-occupiers agreed or strongly agreed (see section F.2).

Beyond the impact analysis, there are a number of implementation and other considerations that are important when making the decision, including whether certain properties should be excluded from the minimum standard based on the costs relative to the benefits for those specific properties.

Stakeholders (internal and external) suggested a features-based minimum standard would be a preferable short-term option, with a performance-based option preferred in the longer-term. If the implementation of a performance-based standard, and capital costs could be managed (for example, through exemptions and/or maximum expenditure limits) with a sensible trade-off for benefits, it may become a more viable option.

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Appendices

Minimum standard examples in other jurisdictions A

This appendix provides a brief review of regulations that have been introduced in other developed countries to improve the energy efficiency performance of rental properties.

The United Kingdom and New Zealand regulations discussed below provide quality examples of performance-based standards and feature-based standards, respectively. A number of other jurisdictions have similar or related policies, including Flanders, Scotland, and several cities in the United States. Many programs are relatively recent or are still in the process of meeting compliance, and as a result, impacts are not yet known or well evidenced.

A.1 England and Wales

A.1.1 Policy summary

In England and Wales, properties newly rented out or renewed in the private rental sector must have a minimum energy performance rating of E on an Energy Performance Certificate (EPC) as part of their Minimum Energy Efficiency Standard (MEES).

An EPC provides information on the energy efficiency of a property and gives it a rating from A (very efficient) to G (inefficient). EPCs were introduced in England and Wales on 1 August 2007 as part of Home Information Packs (HIPs) for domestic properties with four or more bedrooms. Over time this requirement was extended to smaller properties. When the requirement for HIPs was removed in May 2010, the requirement for EPCs continued.

Existing regulations state that EPCs much be provided to potential buyers and tenants before a property is rented or sold.

The energy survey needed to produce an EPC (which has a 10-year validity period) is performed by an assessor who visits the property, examines essential items such as loft insulation, domestic boiler, hot water tank, radiators, windows for double glazing, and so on. The assessor then inputs the observations into a software program that performs the calculation of energy efficiency. The program generates a single number for the rating of energy efficiency as well as a recommended value of the potential for improvement.

A.1.2 Implementation and enforcement

From 1 April 2018, unless exempted, properties in England and Wales must meet the rating at the renewal of a lease. The regulations will apply to all existing tenancies on 1 April 2020, and this will extend to all rented commercial buildings from April 2023. After this time, all leased properties must have the rating, and the EPC should be available to potential tenants at the time the lease is signed.

District councils have the responsibility to enforce EPCs and can request a copy anytime up to six months after one would be required. Accordingly, local authorities will be empowered to serve compliance notices where they believe a property within the scope of the regulation does not meet the standard. They also enforce compliance with the regulations, with sanctions up to £5,000.

Residential rental providers are required to make improvements up to £3,500 to achieve an E rating. Rental providers who cannot reach the E standard within this cost limit can apply for an "all improvements made" exemption which lasts for up to five years.

Further exemptions can be granted to rental providers in the following prescribed circumstances:

- the rental provider is unable to obtain tenant or other third-party consent to undertake improvements
- the required improvements are assessed by an independent surveyor to:
  - devalue the property by more than 5 per cent
  - (in the case of wall insulation) negatively impact the fabric or structure of the property.

The cost of EPC assessment is in the range of £60–£120, and the cost of measures is also variable.

A.1.3 Complementary measures

In the UK, the Energy Company Obligation (ECO), which has similarities to the ACT EEIS scheme, provides some financial support for improving energy efficiency in some homes. This includes roof, wall and secondary insulating measures and repair and replacement of boilers and electric storage heaters.

The ECO is implemented through three mechanisms for different groups: the Home Heating Cost Reduction Obligation (for people receiving certain benefits and living in owner-occupied or private rental premises), the Carbon Saving Community Obligation (in areas of low income, people receiving certain benefits and living in private domestic premises including social housing, and vulnerable households in rural areas) and the Carbon Emissions Reduction Obligation.

In addition, the UK government supports Green Finance Deals. These are loans that are repaid through energy bills. These financing arrangements are optional and offered through energy providers. The repayment on the loan is limited to the savings made on the energy bill.

A.1.4 Impacts

Two studies have been published which illustrate the early impacts of the policy. The first, by Sayce & Hossain (2020) collected responses from the real estate industry, including valuers, asset managers, lawyers and building consultants. Their findings include that:

- industry finds compliance (including exemptions) too easy and there is limited enforcement
- valuers found that while MEES was part of the valuation process, that it had a limited impact
- many found that EPCs were a blunt tool
- some investors are changing their portfolio to reflect a low carbon future.

However, the authors note that the sample size is small, and the results are preliminary.

The second paper, by French (2019), suggests that non-compliant properties are being sold by investors at a discount, sometimes greater than the cost of retrofitting properties, which the author suggests stems from unforeseen costs and risks to investors — including that standards may either rise in the future or be enforced more stringently. However, the French paper does not provide data, and acknowledges that the changes are still recent. In a subsequent paper, the author notes that COVID-19 has been the most dramatic influence on the property market in 2020 (French, 2020).

A news article from July 2020 (Cuff) reports that few enforcement actions have occurred as a result of the new laws. Only six per cent of local councils had taken any kind of enforcement action, and only 20 penalties had been raised by approximately half of those councils, as shown in Table A.1. These were for an average penalty of £3,859 — roughly equivalent to the cost-cap of the improvements required below which rental providers are required to make the improvements.

Table A.1 Councils that have taken enforcement action, July 2020

Council	Compliance notices	Financial penalties	Total fines (£)
Liverpool City	143	0	0
Rotherham	105	0	0
East Lindsey	47	2	3,250
Bristol City	43	1	3,000
Newcastle upon Tyne	36	2	10,000
East Suffolk	26	5	24,000
Cherwell District	12	1	2,000
Amber Valley	11	0	0
Oxford City	8	0	0
North Kasteven	7	1	5,000
Blackpool	4	0	0
Central Bedfordshire	2	2	8,000
Kettering Borough	1	1	4,000
South Derbyshire	1	1	4,000
Gedling Borough	1	1	2,350
Buckingham	1	0	0
Hertsmere	1	0	0

Source: (Little punishment for landlords flouting energy efficiency rules designed to protect renters, 2020)

A.2 Scotland

A.2.1 Policy summary

Scotland is currently implementing a minimum standard similar to that in England and Wales, where rental properties must reach a minimum EPC energy rating of E, progressively moving to a D rating at the start of a new tenancy (by 2022). All rental properties will need a D rating regardless of the start of the tenancy by 2025. The standards were to be introduced in 2020 but have been delayed due to COVID-19. The standards are included as part of existing minimum standards for repair, conditions and features of a rental property.

A.2.2 Implementation and enforcement

The standards were to be phased-in in four steps:

— from 1 April 2020, any new tenancy requires the property to have an EPC of at least E-level

— from 31 March 2020, all rented properties need to have an EPC of at least E-level

— from 1 April 2022, any new tenancy will require the property to have an EPC of at least D-level

— from 31 March 2025, all rented properties will need to have an EPC of at least D-level.

Though, as noted, COVID-19 has delayed the implementation of the regulation, and it is unclear when the measure will be reintroduced.

As with the policy in England, the EPC should be available to tenants at the time the lease is signed or upon request of local authorities, though local authorities do not often ask for evidence of an EPC. If a property fails to meet the standards, then they are first referred to a Housing and Property Chamber, a specialist body that helps tenants and rental providers mediate disputes. There are penalties of up to £4,000 for failure to comply, with an additional £2,000 for failure to comply with a previous compliance notice.

Exemptions for rental providers include:

— where improvements have been substantially made, but the rating is not met
— improvements will damage the structure
— tenants prevent work or improvement to take place
— there are protected environments at the premises
— improvements are likely to damage the heritage listing or conservation of the property
— when rental providers plan to demolish a property, and a notice of demolition is provided
— local authorities create their own exemptions.

A.2.3 Complementary measures

As part of this measure, the Scottish Government-funded Home Energy Scotland to provide support and financial assistance to rental providers. This support includes information, loans and incentives to uptake renewable technologies. Though many these supports are available to all property owners, there is a specific Private Rented Sector Landlord Loan which is based on a quote from a qualified tradesman.

A.2.4 Impacts

The standard has just been introduced, so its impacts have not been evaluated yet.

A.3 New Zealand

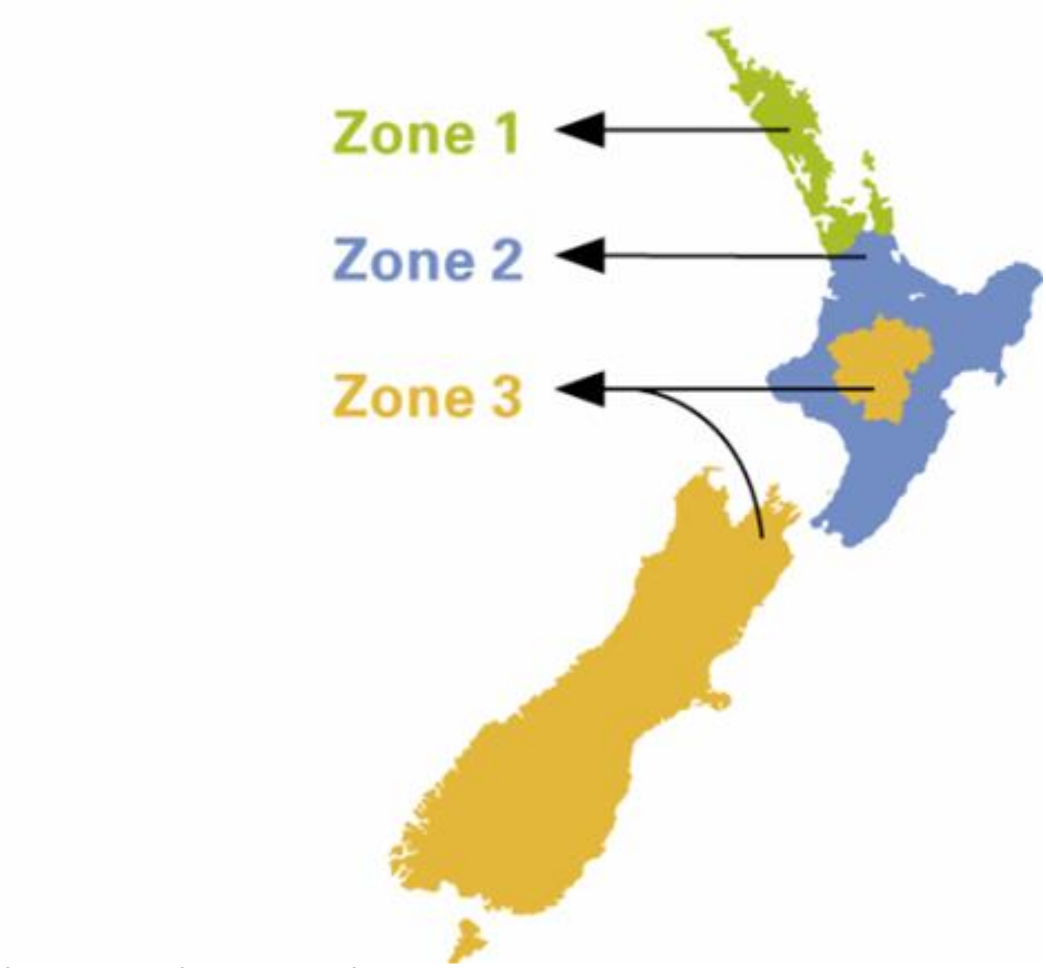
A.3.1 Policy summary

The New Zealand Government introduced regulations — the Healthy Homes Standards — that ensure that all rental properties that currently have no or substandard insulation in the ceiling or underfloor must have new insulation installed in all habitable spaces (where it can practically be installed) to a minimum thickness of 120mm or to the following levels (as per the 2008 New Zealand Building Code):

— Zones 1 and 2 (warmest and intermediate areas): Ceiling R 2.9, Underfloor R 1.3
— Zone 3 (coldest areas): Ceiling R 3.3, Underfloor R 1.3.

The three climate zones are shown in Figure A.1.

Figure A.1 Climatic zones used in NZ insulation regulation for rental properties



Source: New Zealand Government Tenancy Services

The minimum standards were introduced with a number of other standards, including ventilation, moisture ingress and draught stopping. All properties must also have a heating appliance installed, which can heat the premises to 18°C, of which “inefficient, unaffordable or unhealthy” options — for example, open fire or unflued gas heaters — may not be compliant.

Rental properties that have insulation that was installed before 1 July 2016 must be upgraded if the ceiling and underfloor insulation is no longer in reasonable condition or if it did not meet or exceed specified R-value levels (Ceiling R1.9 for lightweight construction, e.g. timber-framed; R 1.5 for high mass construction, e.g. concrete block or solid masonry; and R 0.9 for underfloor) at the time the insulation was installed.

If the insulation is not in reasonable condition, is damp, damaged or incomplete, affected areas must be upgraded to meet the new insulation minimum requirements.

A.3.2 Implementation and enforcement

The standards were introduced in July 2016 for public and community housing and July 2019 for all private rental providers. Boarding houses and Kāinga Ora (a Maori housing provider) have to comply by 2021 and 2024, respectively. All rental properties must be compliant by 2024, reflecting concerns regarding industry capacity and rental provider ability to comply. All new tenancy agreements will have to include a statement from the rental provider about the extent of insulation in the ceiling, underfloor and walls of their property.

Under the legislation, rental providers are responsible for ensuring compliance of their properties. The Ministry of Housing and Urban Development has an investigations team that will make up to

2,000 risk-based assessments per year. Tenants who believe their property does not meet the standards should first approach their rental provider to resolve the dispute. If the issue is not resolved, the tenant can apply to the Tenancy Tribunal for mediation or a hearing.

The average cost of retrofitting both ceiling and floor insulation has been estimated at approximately $NZ3,300 (excluding GST), which is borne by rental providers. If they increase the rent, they must comply with the Residential Tenancies Act and give 60 days' notice. Penalties for failure to comply include fines of up to NZ$4,000.

Exemptions are available in several circumstances for parts of the Healthy Homes standards where:

- installation of insulation is not practical because of the physical design or construction of the property. Guidance is provided on what is 'practical' and relates to:
  - minimum clearance space
  - size of the access hole
  - type of roof
- within 12 months of the commencement of a tenancy, the rental provider intends to demolish or substantially rebuild all or part of the property
- the rental provider is not the owner of the whole tenancy building, and upgrades would have to be installed in a part of the building not directly owned
- a property is purchased and immediately rented back to the former owner-occupier, in which case a 12-month exemption will apply from the date of purchase
- for certified passive buildings.

Like the regulation in England and Wales, the New Zealand regulation has a staged introduction with a considerable lead time. The exemptions provided for in the New Zealand regulation are also sensible from an economic perspective in that regulations should only apply if benefits exceed costs. Lastly, in New Zealand, a credible compliance mechanism has been put in place through the expansion of the Tenancy Tribunal's enforcement powers and the sizeable sanctions that can be applied to rental providers for non-compliance.

A.3.3 Complementary measures

The new standards were introduced alongside widespread information and education campaigns to inform rental providers and tenants of their obligations and rights.

A.3.4 Impacts

A regulatory impact assessment of the new regulation, before its implementation, estimated a benefit-cost ratio (BCR) of 2.1. This BCR applied to the broader proposed regulation, which includes the mandatory installation of smoke alarms in rental properties. As the standards are still to be phased-in completely, no analysis of the impacts was identified.

A.4 Burlington, Vermont USA

A.4.1 Policy summary

The City of Burlington has a city ordinance aimed at dealing with the split-incentive problem related to the energy efficiency of rental properties. Limited vacancy rates, which deprive tenants of choices, are part of the justification of the policy intervention in the market. The ordinance forces rental providers, at the time of sale (TOS), to make investments into energy-saving measures, though they focus on 'weatherisation improvements', which are considered the cheapest option.

This means that a rental property that has been owned for many years is unlikely to be as 'invested in' as a property that has been sold multiple times.

The ordinance lists a series of standards, including:

- insulation
- electric water heaters
- duct and pipe insulation
- windows and door glazing
- heating and hot water appliances (recommended but not required) though there are separate ordinances around heating appliances.

The ordinance requires rental units (focused on apartments where heating is paid for by tenants) to receive an investment of three per cent of the sales price or $1,300, whichever is less, at the time a rental property is sold. A price of investment limit is included to prevent burdensome costs from being passed onto tenants. Estimates are that average costs are between US$650-750.

Additionally, any investment is limited to a seven-year payback period. Therefore, if a standard requires a level of insulation that does not pay-off in seven years, it is not required for that property. The above cost-cap (and pay-off term) means that all standards do not need to be met. Therefore, the ordinance is primarily a spending threshold rather than an outcome threshold — that is neither feature-based nor performance-based — to incentivise rental providers to make investments that produce a return for both the tenant and the rental provider.

Burlington is currently extending the policy to all rental properties as part of a new minimum standards housing code. In this new form, the requirement would not just be triggered at the time of sale but rather be applied to all buildings, which would be inspected on a one- to five-year cycle. They also propose to simplify the spending limits to make compliance more straightforward.

A.4.2 Implementation and enforcement

The policy applies to rental properties at the time of sale for apartments or units where the tenants are required to pay for their own heating costs. Either the buyer or the seller can undertake the works, which can be negotiated.

There is a US$30 administration fee associated with a property inspection associated with installed appliances. There are lists of qualified weatherisation contractors who can undertake these upgrades.

Exemptions to the policy include:

- rental properties not rented between 1 November and 31 March (winter) each year
- new constructions subject to other energy efficiency requirements
- hotels and motels and other
- buildings or apartments where heating costs are paid by the rental provider.

A.4.3 Complementary measures

The Burlington Electric Department, the monopoly utility in Burlington, provides a number of energy efficiency programs to help households become energy efficient. This includes information, rebates, technical assistance and electric metering devices. The Burlington Electric Department has programs designed specifically for both tenants and rental providers.

A.4.4 Impacts

No analysis of the impacts of the program was identified.

A.5 Boulder, Colorado USA

A.5.1 Policy summary

In 2011 "SmartRegs", an updated form of licencing for rental properties, were introduced by the Boulder City Council. These SmartRegs obliged rental providers to meet a minimum energy efficiency rating using the existing rating system (Home Energy Rating Score) or according to a checklist inspection path, which is a quasi-feature based option for the purpose. The checklist inspection path includes minimums along with a number of aspects of the shell and inclusions, including:

— water conservation measures such as faucets and appliances
— wall insulation (R-value)
— windows
— ventilation infiltration
— ceiling insulation (R-value)
— floor insulation (R-value)
— pipe/duct insulation
— heating/cooling systems installed
— lighting
— hot water
— whole house fans
— refrigeration appliances supplied
— solar thermal
— solar photovoltaics
— energy management devices such as teal time monitoring devices or programable thermostats
— other discretionary features such as passive solar design, carbon offsets or innovative practice.

A.5.2 Implementation and enforcement

Rental providers in Boulder were previously required to obtain a four-year licence prior to renting their properties. As part of this, rental providers must pay for an inspection of the property for a small fee (initially $50, then $150 from 2018 onwards). The SmartRegs were introduced with a two-cycle grace period, meaning the regulation was fully implemented by the start of 2019. Non-compliant properties are subject to a series of increasing penalties, including a $250 investigation fee and fines varying from $150 for a first notice to up to $1,000 for a third notice. The program also allowed for a "Technically Impractical Exemption", which allowed properties that have *already failed* an inspection to appeal penalties and allow a licence to be granted where it is not practical to meet the standards.

A.5.3 Complementary measures

There have been additional technical and financial support measures to support rental providers provided by the city and county. For example, the EnergySmart program provides both information, technical support, and rebates and financing to support owners and rental providers improve the energy efficiency of their properties.

A.5.4 Impacts

By the end of 2018, 96.2 per cent of properties were compliant. By the end of 2019, at the end of the grace period, the policy had a 99 per cent compliance rate — this accounted for 22,487 rental properties, with only 230 properties not compliant at that time.

Units that needed improvements to reach compliance took an average of two upgrades each. The most common upgrades were attic, underfloor and wall insulation. These upgrades costed an average of US$3,022 per unit and received US$579 in rebates on average — for a total cost of approximately US$2,450 to the rental providers.

The city estimates that as a result of the measure, by the end of 2018, the city had saved approximately 1.9 million kWh of electricity, 460,000 therms of natural gas, US$520,000 in energy costs and 3,900 metric tons of carbon dioxide.

A.6 Victoria, Australia

A.6.1 Policy summary

The Victorian Government is currently implementing minimum standards for rental properties as part of a suite of reforms to rental laws and property standards. The laws focus, with regard to energy efficiency, on installing energy-efficient heating appliances.

Other improvements, such as water-efficient fixtures, are also a part of the minimum standards.

In addition, the Victorian Government is currently investigating insulation standards and hot water systems to be included in the minimum standards. These standards have been delayed due to COVID-19.

A.6.2 Implementation and enforcement

Rental providers have a responsibility to ensure their property meets the minimum standards before they rent out the property. If a rental property does not meet the minimum standards, tenants can end the rental agreement immediately before moving in, or make an urgent repair request to improve the property up to standards any time after moving in.

A.6.3 Complementary measures

Over a three-year phase-in period:

— From 29 March 2021, a heater must be installed in the main living area. If a heater is not already installed, it must be a 2-star minimum appliance.

— From 29 March 2023, a 2-star minimum heater must be installed in the main living area.

For class 2 buildings, where an energy-efficient heater cannot be practically installed, any heater must be installed in the main living area.

The Victorian Government runs several complementary measures to assist Victorian households in becoming energy efficient. In particular, their Victorian Energy Upgrades (VEU) program acts much like the ACT's EEIS, providing information and financial support to improve energy efficiency. Solar Victoria provides a specific rebate for installing solar panels on rental properties to address the split incentive problem with rooftop solar. The rebate is up to $1,850 and the option of interest-free loans until 30 June 2021.

A.6.4 Impacts

No analysis of the impacts of the program was identified.

A.7 Flanders, Belgium

A.7.1 Policy summary

The housing code has included minimum roof insulation since 2015, which is being implemented through more holistic safety, health and habitability standards that apply to all rental properties. These standards also include a range of criteria, such as the condition of property and access to water. Insulation must meet a minimum R-value. An amendment in 2019 introduced double glazing to the code.

A.7.2 Implementation and enforcement

The 2015 amendment to include roof insulation had a five-year phase-in period. This means that all rental properties much have roof insulation as of 1 January 2020. The 2019 amendment to include double glazing on windows has a further five-year phase-in period.

The scheme runs through a penalty point system, where failure to comply with a range of minimum standards results in 'points' shown on a 'conformity certificate'. These certificates are not required to be shared with tenants. Scoring 15 or higher penalty points legally prohibits the renting out of the property. While the conformity certificate is an obligation, in many cases, it is not strictly necessary at the time of renting out the property.

The assessment is not strictly mandatory in all municipalities, so compliance is mixed. However, tenants can freely request an investigation at no charge. The result is that different municipalities have varying degrees of enforcement and compliance. However, the scheme does not include *any* exemptions.

A.7.3 Complementary measures

The scheme is supported by communications campaigns by individual municipalities, phased implementation and tax-based grants of up to €23 per m^2 for dwellings occupied by vulnerable tenants.

A.7.4 Impacts

The impact of the measure is so far low due to the phase-in periods, low minimum requirements, and uneven enforcement between local authorities. No detailed information on the impacts of the standards were found.

A.8 European Union obligations of member states

The European Union has taken measures to direct its member states to begin to deal with the split incentive problem and poorly performing housing. These policies do not enforce minimum standards but oblige action by their member states to investigate and propose action to address the problem. These include:

— **Article 19(1)(a) – Energy efficiency Directive:** "Member States shall evaluate and if necessary take appropriate measures to remove regulatory and nonregulatory barriers to energy efficiency… in particular as regards: (a) the split of incentives between the owner and the tenant of a building or among owners, with a view to ensuring that these parties are not deterred from making efficiency-improving investments that they would otherwise have made by the fact that they will not individually obtain the full benefits or by the absence of rules for dividing the costs and benefits between them, including national rules and measures regulating decision- making processes in multi-owner properties."

— **Energy Performance of Building Directive 2018 recast:** "Member States should provide clear guidelines and outline measurable, targeted actions as well as promote equal access to financing, including for the worst performing segments of the national building stock, for energy-poor consumers, for social housing and for households subject to split-incentive dilemmas, while taking into consideration affordability. To further support the necessary improvements in their national rental stock, Member States should consider introducing or continuing to apply requirements for a certain level of energy performance for rental properties, in accordance with the energy performance certificates."

These directives occurred after 2019, and responses by member states are still largely forthcoming.

Impact analysis methodology B

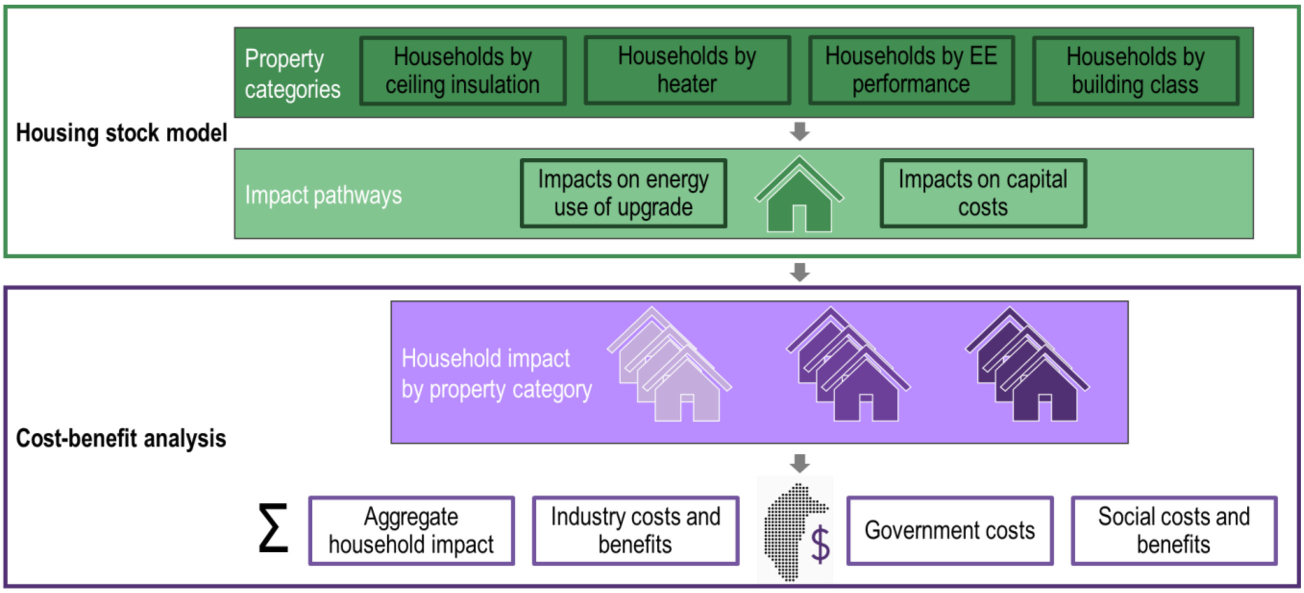
The analysis has been conducted through a two-stage approach:

— analysing the impact of a minimum standard on a sample of households[11] to which a minimum standard applies (described, in detail, in Appendix C), then

— aggregating up to an economy wide level, by summing across an estimate of the number of properties that the minimum standards will impact and incorporating economy-wide impacts in the more holistic CBA.

The broad structure of the analysis is given in Figure B.1.

Figure B.1 Framework for analysis



* Health and comfort impacts partially analysed through sensitiviy analysis.

Note: Household impacts describe the combined impact on tenants and rental providers. In realtiy, the minimum standard will represent a transfer between these two agents. For the analysis we have assumed that the costs are incurred by rental providers. Distributional impacts will be described as per section 5.2.3.

Source: ACIL Allen

The results of the household level analysis are aggregated at the economywide level using information about the existing rental dwelling stock, information/assumptions about the number of properties not currently compliant, the 'churn' within the rental market and other parameters and assumptions (detailed further in the following sections of this document). In effect, the results of the household level analysis are inputs into the economywide level CBA, which is the focus of this analysis.

[11] Where households refer to both tenants and rental providers as a single entity for the purpose of modelling.

As is best practice for cost-benefit analyses, the overarching cost-benefit model (CBA model) developed for this study includes all quantifiable societal costs and benefits associated with the policy, including government and industry costs, and societal benefits such are a reduced need for the ACT community to pay for renewable offsets. As noted in Section 5.3, there are a range of other societal impacts that the energy efficiency improvements may have which are not readily quantifiable. These have been qualitatively discussed.

The costs and benefits that are included in the CBA model are outlined in Table B.1.The CBA model quantifies these costs and benefits separately for each scenario under consideration, year-on-year over the period of the analysis.

The analysis of costs and benefits have been guided by feedback and input received from stakeholders during consultations.

Table B.1 Costs and benefits included in the CBA model

	Costs	Benefits
Households	– Cost of energy efficiency upgrades – Cost of maintenance/servicing the installed upgrades – Cost of safety or performance assessments – Householder time during energy assessment (under a performance-based policy)	– Energy savings accruing from reduced energy use – Health benefits from avoided domestic gas usage
Industry	– Property manager time required to organise upgrades – Training time for performance assessors (performance-option) – Insurance required for performance assessors	
Government	– Administration and enforcement costs – Cost of any complementary measures (e.g. information campaigns, etc. – but excluding rebates/subsidies) – Costs associated with energy efficiency upgrades for public housing (Housing ACT)	
Society		– Reduced greenhouse gas emissions from household gas use – Reduced renewable energy offsets for the ACT – Avoided electricity network costs – Improved air quality benefits from carbon and gas generated electricity (not attributable to ACT residents) and from reduced gas use.

Source: ACIL Allen

As noted above, standard practice is to undertake cost-benefit analysis of the policy options from the perspective of the broader ACT community, with impacts that are transfers between stakeholders (such as between the ACT Government and rental providers and between rental providers and tenants) netted out. Nevertheless, it is important to consider the implications of some of these transfers on each type of stakeholder. These distributional impacts have been separately analysed in the RIS.

Additional details about our proposed analysis of costs, benefits and distributional impacts is provided in the sections below.

Further detail on the assumptions and data is included in appendix section B.5. Assumptions underlying the housing stock model are given in Appendix C.

B.1 Analysis of benefits

B.1.1 Quantifiable benefits

As noted in section 5.1, the following benefits have been quantified in the RIS as part of the CBA:

- **Energy benefits** – these are benefits from the saved cost of supplying energy. This is the most certain measure of benefits available and includes:
  - *Reduced energy costs* – the primary benefit of minimum standards for residential rental properties is reduced energy costs. These are realised through lower electricity, gas or firewood use by tenants. For a small subset of households, this is supplemented by offsetting rooftop solar — and, when considering impacts on tenants, exports to the electricity grid.
  - *Reduced network costs* – the electricity network is built to provide electricity at peak usage. A reduction in the ACT's peak electrical usage will marginally lower network costs associated with investments in additional transmission and distribution network capacity.
  - *Reduced renewable energy offsets* – the ACT has a 100 per cent renewable energy target. It contracts with renewable energy suppliers to ensure that this target is met., effectively offsetting electricity that is sourced from fossil fuels. The renewable energy suppliers are paid a feed-in support payment that reflects the difference between their costs and the revenue received through the wholesale electricity market. Reducing electricity use in the ACT thereby reduces the amount that is paid to offset the amount that would otherwise be paid to offset electricity that is sourced from fossil fuels.
- **Benefits from reduced domestic greenhouse gas emissions** – domestic burning of natural gas and firewood contributes to the ACT's greenhouse gas emissions. Where rental households burn less of either of these energy types, it will reduce greenhouse gas emissions. Because the ACT offsets its electricity sourced from fossil fuels, there is no greenhouse gas emissions benefit attributable to reducing electricity use. This is a somewhat more uncertain measure of benefit. It is clear that greenhouse gas emissions represent a cost to society, and that reducing these emissions therefore represents a benefit. However, since the removal of Australia's carbon pricing mechanism in 2014, there is no universally agreed transparent price which can be assigned to these emissions.
- **Health benefits** — two types of health benefits are modelled as outlined below (one of these in the central case and the other as part of the sensitivity analysis). While it is clear that reduced energy consumption can improve health in different ways, these benefits are generally regarded as highly uncertain and speculative and should be interpreted as an indicative potential value of the wellbeing that could be generated through energy efficiency upgrades.
  - *Health benefits related to improved air quality* – two types of air quality health benefits are explored in the analysis:
    - health benefits associated with improved air quality due to reductions in domestic gas burning
    - health benefits associated with improved air quality due to reductions in coal and gas generated electricity. Even though the ACT offsets its electricity sourced from fossil fuel, part of its electricity use is associated with coal or natural gas plants (predominantly in New South Wales). Burning fossil fuels in these power plants produces particulate matter which is harmful to the health of surrounding residents. Despite not being a benefit attributable to the ACT, it is an auxiliary benefit of reduced electricity use.
    - *Tenant health benefits* – as noted in section 2.3.1, poor thermal control has impacts on the health of tenants. These health benefits have been explored through sensitivity analysis only, where they are modelled as a substitute for reduced energy use.

More details about our approach to measure these benefits are provided in the sections below.

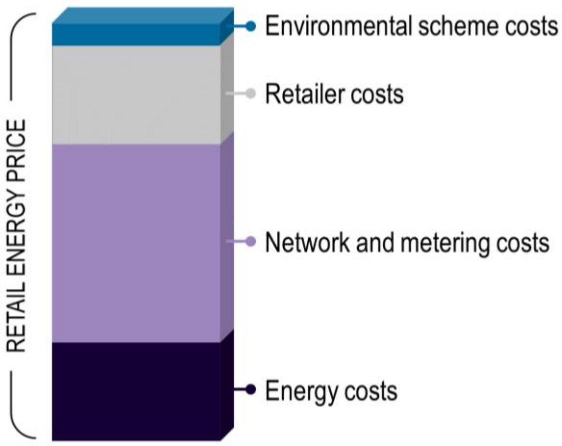
Reduced energy costs

One of the main benefits of the proposed minimum rental standards will be a reduction in energy consumption in rental properties, which will translate into reduced energy bills for households.

As noted above, the estimated reductions in energy consumption will generate benefits to households in the form of reduced expenditure in energy bills. In calculating the value of energy savings, it is critical to not confuse benefits with distributional impacts. For example, the benefits of energy efficiency are often misconstrued to include the reduction in electricity bills experienced by the customer as a result of their decreased energy usage. It is true that from the customer's point of view, this reduction represents a benefit. However, there is a similar and opposite reaction with some of the reductions in costs for these customers redistributed to other customers. For example, total network costs will only be reduced if network augmentation can be deferred or avoided. Many of the retail costs of energy (such as costs associated with call centres, revenue and billing collection, customer acquisition and retention, and IT systems) are driven by the number of customers, not by energy consumption. From the perspective of energy efficiency, these costs are 'fixed'. The benefits to society of a decrease in energy usage are not found in the changing amounts that customers pay their energy retailers, but in avoided marginal electricity supply chain costs.

The retail energy price broadly comprises four components as illustrated in Figure B.2.

Figure B.2 Components of the retail energy price



Source: ACIL Allen

The **energy cost component** comprises a fixed component (capital and fixed operating and maintenance costs) and a variable component (fuel and variable operating and maintenance costs). In the short run, the variable fuel and operating costs are avoided when energy usage is reduced. Wholesale energy price projections are used as a proxy representing the marginal cost saving associated with the reduced energy from investments in energy efficiency measures in the existing residential building stock.

In the long run, investment in new generation capacity may be deferred or avoided. However, new generation capacity is currently driven by a range of policy initiatives that are incentivising additional new energy supply and reductions in the demand for energy from centralised generation.

The impact of minimum energy efficiency standards on rental properties in the ACT on the capacity of generation in the wholesale electricity market is not material relative to these policy initiatives.[12]

The **network costs** are driven by the size (capacity) of the network and the metering costs are driven by the number of customers; they are not driven by energy usage unless that energy usage occurs at the time of peak demand in a location where the network is constrained.

The electricity distributors' revenues are regulated in accordance with a revenue cap – that is, the revenue is fixed in the short term. In the longer term, total network costs would only reduce if:

— there is a deferral in the augmentation of the network, which would only occur if the reduction in energy is at the time of peak demand on the network and in the location where the network is constrained

— the expenditure for replacing the network can be reduced by replacing network components with lower capacity components.

Reductions in network costs as a result of the proposed standards have been included in the analysis.

The **retailer costs** comprise the retailer's operating costs and margin. The retailer's operating costs (call centres, revenue and billing collection, customer acquisition and retention, and IT systems) are driven by the number of customers rather than the energy used. These costs would not change as energy usage decreases through the additional energy efficiency investments driven by the minimum standards.

It is generally assumed that the margin is a percentage applied to the other costs. If energy costs decrease, then the operating margin applied to those costs would also decrease. A reasonable approximation is that this is offset by the assumption that the total wholesale energy costs (rather than the variable wholesale energy costs) are avoided.

Most of the **environmental scheme costs** are fixed based on a fixed target that is allocated on the basis of energy usage. As such, the amount recovered per unit of energy used increases as energy usage decreases. The societal costs associated with environmental scheme costs are not reduced as energy usage reduces with more investments in energy efficient measures, unless the target changes.

In light of the above discussion, to assess the societal benefit of a reduction in the energy used by rental properties due to the minimum standards, we have considered the components of the retail prices that would result in a reduction in costs incurred by society – the avoided wholesale energy costs and the avoided network costs. That is, the components of the retail energy prices factored in the economy-wide analysis to assess the benefits of the proposed standards are:

— the avoided energy costs based on (proxied by) the avoided wholesale electricity prices

— the avoided network costs (these have been calculated based on the incremental reduction in peak demand in each year and the capital expenditure that would have been avoided by that reduction in peak demand).

We note that the use of the capacity and network approach results in BCRs and NPVs that are much smaller than if retail energy prices are used. In effect, there is a redistribution of costs from the occupants of a dwelling with increased energy efficiency to other energy users because of the fixed costs discussed above.

[12] As an example, the minimum objectives of the *Electricity Infrastructure Investment Act 2020 (NSW)* are to construct 12 GigaWatts (GW) of large-scale renewable energy capacity and 2 GW of long-duration storage infrastructure in NSW by 31 December 2029.

This approach is consistent with the Australian Government's handbook (2006) on cost-benefit analysis, which states:

> *One of the first tasks for the analyst is to distinguish the allocative effects of a project, that is, the effects due to changes in the use of resources and in outputs, from the distributional effects. Generally speaking, it is only changes in resource use that involve opportunity costs. Distributional effects may be regarded as 'transfers' – that is, some individuals are made better off while others are made worse off. Distributional effects do not add or subtract from estimated net social benefit. However, they may affect social welfare if the judgement is made that one group derives more value from the resources than another group.*

The distributional effects referred to in the handbook on cost-benefit analysis would be included in the economy-wide cost benefit analysis if retail electricity prices had been used.

Similarly, the Houston Kemp report for the Australian Government *Residential Buildings Regulatory Impact Statement Methodology* (2017) recognises that retail electricity prices were historically used to value the energy savings from energy efficiency activities from a societal perspective, which is not accurate. It states that:

> *Previous studies have used reduction in the retail bill as the benefit, which represents the financial savings to households based on existing tariffs. However, we believe a more accurate approach is to estimate the resource cost savings from reduced electricity and gas consumption, ie, reduction in network and wholesale costs.*

And that:

> *To estimate the benefit from reductions in electricity generation costs, average wholesale market prices can be used as they typically represent suitable estimates for the resource cost savings.*

Following the release of the Houston Kemp report, the energy savings from energy efficiency activities have more commonly been valued at a societal level using avoided wholesale and network costs rather than by using retail prices,[13] although retail prices continue to be used to assess the impact at a household level.

Wholesale and retail electricity and gas price projections were generated by our proprietary *GasMark* and *PowerMark* models of the gas and electricity markets for the National Electricity Market, which account for the NSW Electricity Infrastructure Roadmap released in November 2020.[14] Additional information about these models is provided in Appendix D and our projections of wholesale electricity and gas prices in the ACT are shown in Figure B.3 and Figure B.4.

Firewood prices for the CBA have been sourced from EES's Whole of House Report for the NCC 2022 (Energy Efficient Strategies, 2021) and are assumed to be $1.56 cents per megajoule (MJ)[15] and remain constant in real terms over the period of analysis. The same price was used to represent wholesale and retail prices.

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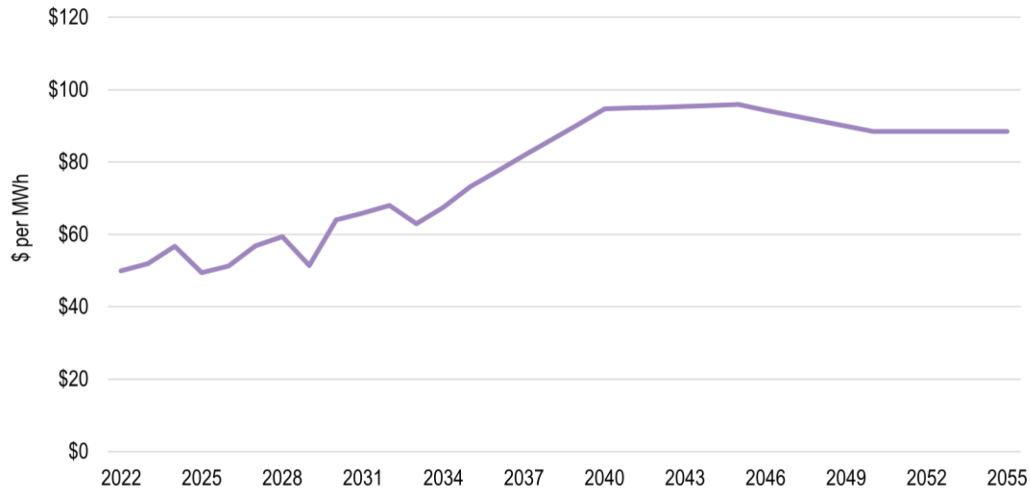
[13] Prior to the release of the Houston Kemp report, the avoided wholesale and network cost approach was used for some analyses but not all.

[14] The Directorate has directed ACIL Allen toward Australian Energy Market Commission energy prices and forecasts for trends over 2020. Unfortunately, the AEMC does not provide long-term forecasts in this time-series. We can use AEMC forecasts in a fixed manner. However, in our view, this would overestimate the costs in the longer-term.

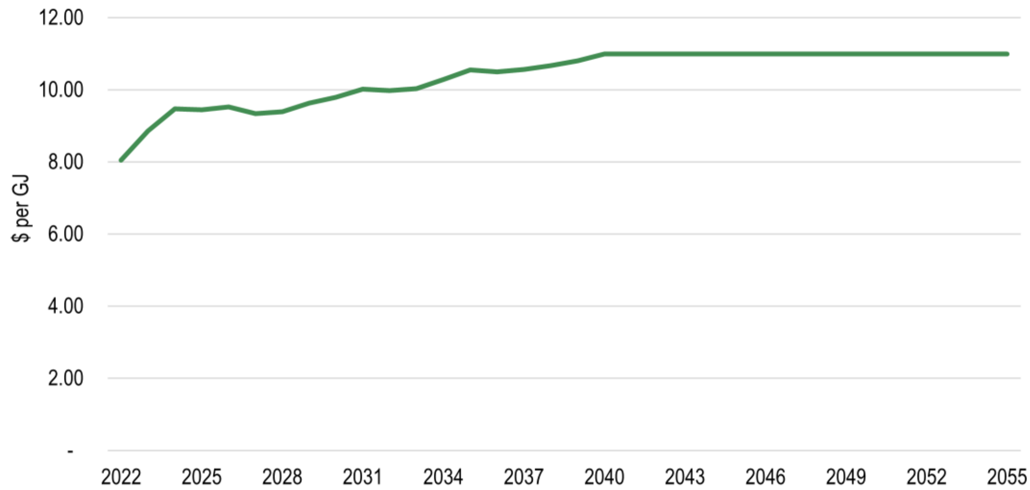
[15] Both for the CBA and distributional analysis.

Figure B.3 Wholesale electricity price projections, $ per MWh



Source: ACIL Allen

Figure B.4 Wholesale gas price projections, $ per GJ



Source: ACIL Allen

The distributional impacts of using wholesale prices is further explained in section 5.2.3.

Retail prices for distributional analysis

As is standard practice, the CBA of the proposed minimum standards was undertaken from the perspective of the broader ACT community, with impacts that are transfers between stakeholders (such as between the government and households, and between households that were subject to the minimum standards and those that did not) netted out. Nevertheless, it is important to consider the implications of some of these transfers on stakeholders, particularly the implications of energy bill reductions on households.

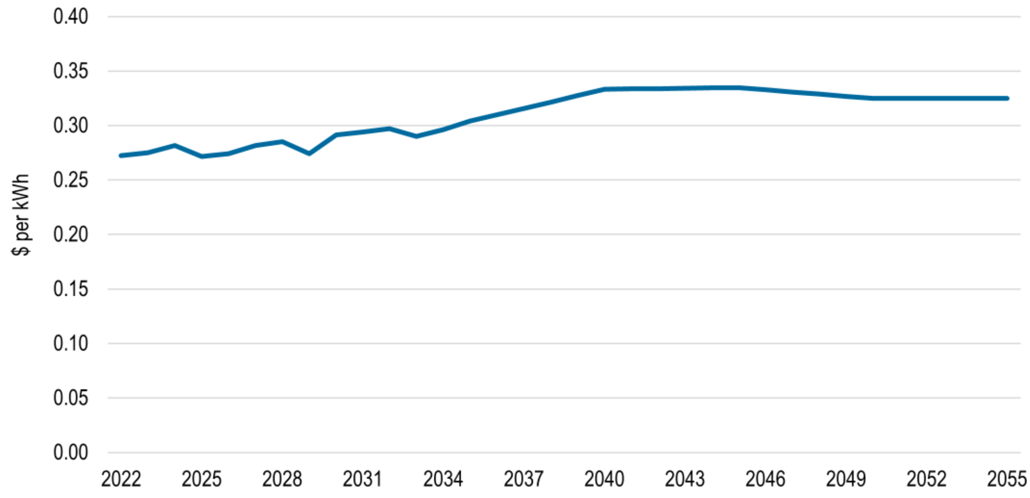
As such, we have also included a distributional analysis in the report that shows the impacts of the proposed changes on households that are subject to the changes. In contrast to the state-wide analysis, this household analysis is done using retail energy prices.

The retail energy prices used for the analysis of the impacts of the modelled scenarios on households are shown in Figure B.5 to Figure B.7. These were based on a number of sources as follows:

- for retail electricity prices, we used prices sourced from Energy Efficiency Strategies' (EES) Whole of House Report for the National Construction Code (NCC) 2022 (May 2021) for the start year and projected the change in these prices over time using information sourced from our proprietary model PowerMark
- for retail gas prices we used the prices in EES's Whole of House Report for the NCC 2022 (May 2021) for the start year and projected the change in these prices over time using information sourced from our proprietary model *GasMark*
- feed in tariffs to value exports to the grid were estimated/projected using the average of the annual large-scale solar dispatch weighted wholesale electricity price plus 6 per cent, which represents loss factors that the retailer will pass onto the end consumer.

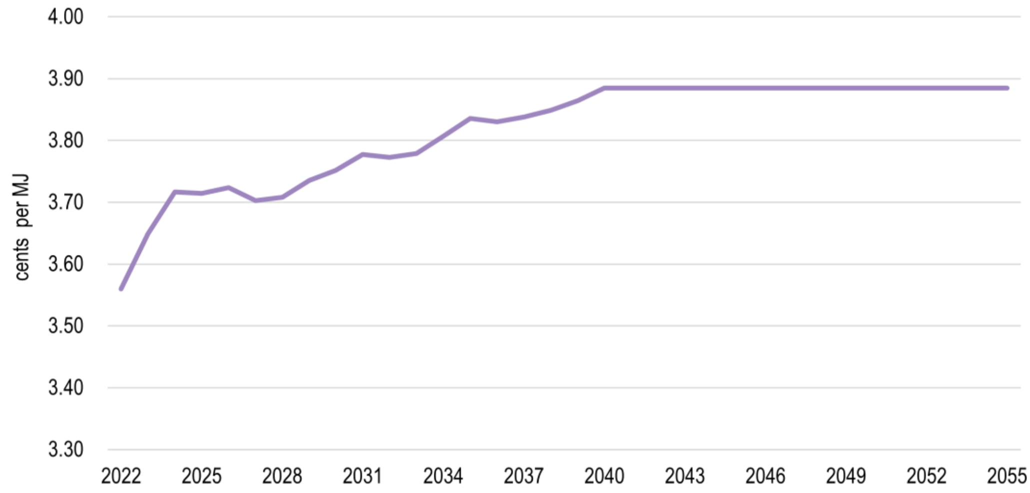
For ease of comparison Figure B.8 and Figure B.9 compare wholesale and retail prices for both electricity and gas.

Figure B.5 Retail electricity prices, $ per kWh



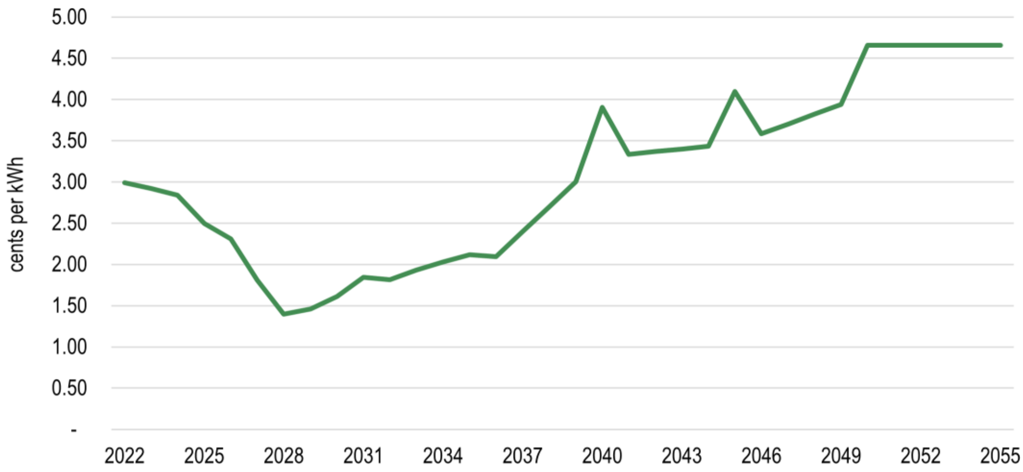
Source: ACIL Allen

Figure B.6 Retail gas prices, cents per MJ



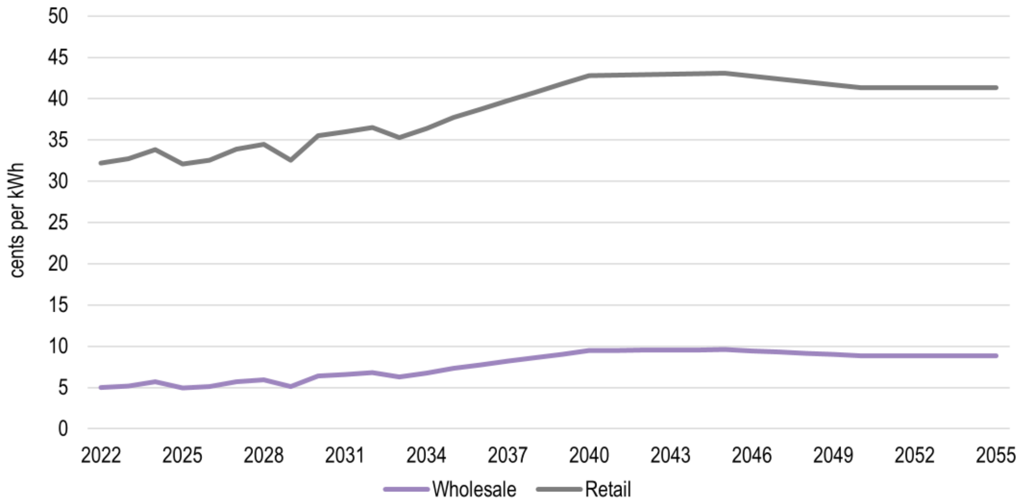
Source: ACIL Allen

Figure B.7 Feed in tariff for PV exports to grid, cents per kWh



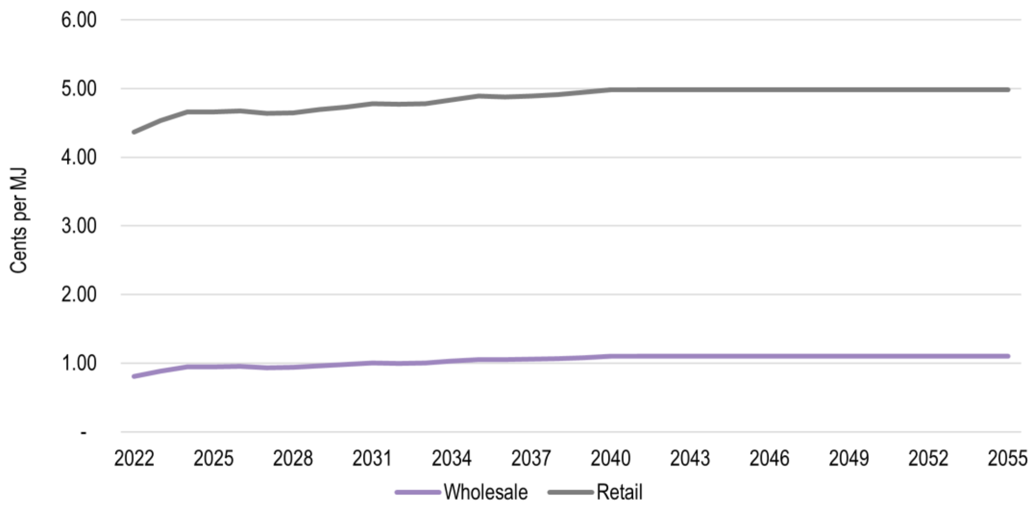
Source: ACIL Allen

Figure B.8 Comparison of electricity prices at wholesale and retail prices, $ per kWh



Source: ACIL Allen

Figure B.9 Comparison of gas prices at wholesale and retail prices, cents per MJ



Source: ACIL Allen

Rebound effect

Energy savings from implemented energy efficiency measures may not materialise. This is referred to as the rebound effect and may take three forms:

1. the take-back effect, where energy users increase their consumption of energy using services (e.g. heating)
2. the spending effect, where energy users spend financial savings from energy efficiency on other energy consuming activities
3. the investment effect, where investment in energy efficiency leads to an indirect increase in economic activity and energy consumption.

The energy efficiency literature often makes note of this rebound effect as a contributing explanatory factor for the differences between projected and actual energy savings. Increased energy use may partly result in improved health impacts of the proposed options.

Empirical evidence suggests that the rebound effect is real. However, the evidence also suggests that the magnitude of the effect is highly variable and context specific.

— The modelling done by Tony Isaacs and Robert Foster for the 2011 mandatory disclosure RIS included a 30 per cent rebound effect (that is, it included a 30 per cent discount to energy savings) (Allen Consulting Group, 2011).
— McKinsey refers a rebound effect of 15 to 30 per cent. (McKinsey & Company, 2009)
— A report by the International Energy Agency on the multiple effects of energy efficiency refers to a total macroeconomic rebound effect in the range of 10 per cent to 30 per cent in the UK and suggests the rate is similar in other developed countries and higher in developing countries. (IEA, 2015)
— O'Leary (2016) suggests than the rebound effect for efficiency alone should be nearer the low end of estimates or around 5 per cent to 10 per cent to expected energy savings. (O'Leary, 2016)

For this analysis we use a rebound effect of 10 per cent. This has been joint-sensitivity tested in section 5.4.4.

Health benefits

Health benefits from improved air quality

The mining and combustion of coal for electricity generation in Australia produces air pollution containing particulate matter, nitrogen oxides, sulphur dioxide, as well as other emissions. These can cause health problems such as respiratory illness and can also affect local economies.

Particulate matter, sulphur dioxide and nitrogen oxides are the main power station emissions contributing to health damage costs. These emissions are associated with respiratory and cardiac diseases.

The estimate of the economic impact associated with the health damage costs from these emissions is based on estimates of health benefits of implementing energy efficiency and clean energy measures produced by Scorgie et al. (2019) for the NSW Government. In this report, the authors estimated health damage costs of coal-powered electricity generation of AUD$2.40 per MWh of total energy generation.[16]

As the estimates in this study were in 2016 dollars, the $2.40 per MWh figure was converted into 2021 dollars using inflation rate estimates from the ABS. This produces a 2021 figure of $2.58 per MWh (being for NSW, this figure relates to electricity generated from black coal).

This figure was then multiplied by the difference in the electricity generated from coal in NSW sourced from our proprietary model *PowerMark*.

In addition to health benefits from reduced pollution from coal generated electricity, we used estimates from the Australian Academy of Technological Sciences and Engineering (ATSE) report on the Hidden Costs of Electricity Generation (ATSE, 2021) on the health costs associated with emissions from Australian combined cycle gas power stations ($0.74 per MWh in 2009 dollars) to estimate the health benefits from reductions in gas-generated electricity and reductions in natural gas use.[17] In 2021 dollars this figure is $0.93 per MWh. This figure was then multiplied by the difference in the electricity generated from gas over time sourced from our proprietary model *PowerMark* and the gas savings calculated previously.

Health benefits from improved thermal comfort

The health benefits from improved thermal comfort used in the sensitivity analysis have been estimated by drawing on the outcomes of New Zealand’s Warm Up New Zealand: Heat Smart program. No similar research has been published to date that quantifies the health benefits in Australia.

A cost-benefit analysis of the New Zealand Government’s Warm Up New Zealand: Heat Smart program indicated that it has generated considerable health benefits. Under the program, subsidies are provided towards the cost of retrofitting insulation and/or installing energy-efficient heating for pre-2000 houses.

To estimate the health savings of the ceiling insulation upgrades, addresses of houses that had received treatment were matched with similar houses to provide a control group of addresses. Data were then obtained on hospitalisation and pharmaceutical costs of the treatment and control

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[16] This estimate represents the health cost reductions per MWh reduction in total energy generation due to energy demand reduction and are based on the life years gained approach for the medium demand shock scenario and the 2026–2118 period (excluding ramp up), and assuming a 7 per cent discount rate.

[17] While ATSE’s estimates relate to combined cycle gas power stations, using natural gas (whether to generate electricity or for other purposes) emits NOx and PM10 particulates and a lower level of SOx and hence it was considered that ATSE’s estimates could be used as proxy for the health damage costs of natural gas use on an equivalent per PJ basis.

groups; benefits were estimated using the difference between treated and untreated houses. Additional benefits were estimated from previous studies under the NZ Heating, Housing and Health Study; these included reduced medical visits, reduced days off school or work and associated reductions in caregiver costs.

The Heat Smart cost-benefit analysis estimated health benefits of NZD 854 per dwelling per annum for community service card holders and NZD 336 per dwelling per annum for other households (Grimes, Denne, & Howden-Chapman, 2012). A breakdown of these estimated health benefits is provided in Table B.2. A large proportion of the health benefits are attributable to reduced mortality.

Table B.2 Breakdown of estimated health benefits

Nature of benefit	Community service card holders	Other households
Hospitalisation and pharmaceutical use related benefits	13%	3%
Benefits imputed from previous studies (reduced medical visits, reduced days of school or work)	11%	28%
Value of reduced mortality	76%	68%

Source: (Grimes, Denne, & Howden-Chapman, 2012)

The New Zealand study did not quantify the comfort benefits associated with additional interior warmth.

The vast majority of the benefits was attributed to ceiling insulation upgrades rather than clean heating upgrades. The study also found that health benefits constituted 99 per cent of all program benefits, compared with 1 per cent for energy savings (from a societal perspective), indicating a high rebound effect.

We estimated the health benefits for insulating an uninsulated class 1 or 2 building in the sensitivity analysis by drawing on the findings of the New Zealand study in combination with the following assumptions:

— an exchange rate of AUD0.95 for each NZD
— placing a 30 per cent weight on the benefits for community service card holders and 70 per cent for other households to arrive at an average health benefit per household
— a 30 per cent downward adjustment for the climatic differences between New Zealand and the Australian Capital Territory, and to account for the fact that the New Zealand program required both ceiling and underfloor insulation be installed wherever possible, and there was also funding for operational measures – clean heating, draught proofing, on-ground vapour barrier, pipe lagging and cylinder wrapping
— scaling the benefits associated with reduced mortality by the difference in the Value of a Statistical Life assumed in the study and for Australia[18]
— scaling based on the rebound factor – the higher the rebound factor, the higher the proportion of estimated health benefits assumed
— escalating by the Consumer Price Index from 2012 to June 2021.

Under these assumptions, the health benefits from insulating an uninsulated Class 1 or 2 building, prior to scaling for the scenarios, were assumed to be valued at $467. The health benefits for

[18] The value of reduced mortality was NZD 649 for community service card holders and NZD 229.11 for other households. The Value of Statistical Life used in the study was NZD 3,467,213. As of August 2019, the Value of Statistical Life in Australia, as published by the Office of Best Practice Regulation, was AUD 4.9 million.

upgrading the insulation of a class 1 or 2 building were estimated by scaling the health benefits for an uninsulated building based on the difference in the energy required to heat or cool the building.

As discussed above, stakeholders discussed the reduced effectiveness of ceiling insulation if there are any gaps. We have assumed that the likelihood of gaps in the insulation will be greater when the ceiling insulation is installed by a DIYer rather than a professional. We have therefore discounted the health benefits by 20 per cent if the installation is undertaken by a DIYer rather than a professional.

A specific study would be required to understand thermal control and thermal comfort for ACT residents, given the unique combination of housing stock, demographics and climate. For example, the assumptions above will not account for the local conditions in Jervis Bay, or in the ACT's more alpine areas.

Reduced greenhouse gas emissions

The proposed minimum rental standards will also reduce greenhouse emissions from energy generation. In the case of the ACT, these reductions are likely to be modest because of its 100 per cent renewables electricity, so reductions in gas consumption or woodfired heating are likely to be the only significant source of emissions savings in the ACT.

The avoided greenhouse gas (GHG) emissions associated with the minimum standards were calculated by:

— estimating the reduction in GHG emissions associated with the proposed changes by applying appropriate emissions intensity factors to energy savings (by source)
— estimating the costs of these emissions by applying an appropriate carbon price series.

More details about the information and assumptions used to produce these estimates are provided below.

Emissions intensity factors

Gas

For natural gas emissions, we used the latest estimates of emissions factors for natural gas consumption reported in the National Greenhouse Accounts Factors (Scope 1[19] and Scope 3[20] metro). Table B.3 provides details of the emissions factors used.

Table B.3 Natural gas emissions factors, kg CO2-e/GJ

State	Scope 3[a]	Scope 1	Scope 1+3
ACT	13.10	51.4	64.50

[a] Scope 3 emissions factors based on estimate for metro areas in each state. Estimates for non-metro areas vary slightly but would not make a significant difference to the overall results.

Source: ACIL Allen based on DISER 2020, National Greenhouse Accounts Factors, Australian National Greenhouse Accounts, October

Firewood

For firewood, a greenhouse gas intensity of 5 kg CO2-e /GJ was used in the modelling based on estimates prepared by George Wilkenfeld and Associates for the Commonwealth Government in

[19] Direct (or point-source) emission factors

[20] Scope 1, plus all indirect factors (such as purchase, consumption and generation through a company's offshore value chain)

relation to closed combustion type heaters (Energy Efficient Strategies, 2021). This has been assumed to remain constant over time.

Cost of emissions

There are multiple approaches to estimate the cost of GHG emissions. Because the burden (costs) of emissions is almost entirely borne by third parties (neither the consumer, nor the electricity generator), it is an example of an economic externality. The value of GHG emissions, therefore, is not internalised in the market, which means that individuals do not make decisions based on the overall impact. This is a classic market failure, making the value of emissions difficult to estimate accurately.

Two approaches have been taken to estimate the value of GHG emissions:

— The **social cost of carbon** (SCC, or sometimes rendered as SC-CO_2), which tries to estimate the marginal impact of an additional tonne of carbon (or equivalent GHG emission) based on the future costs associated with those emissions. The SCC is an inherently difficult to use measure, both because of the difficulty in measuring the impact of a tonne of carbon a long time in the future; and because of the assumptions around the discount rate used to evaluate those impacts. Typically, the SCC is given as a very high, high, medium, and low value — deriving from different measures of the discount rate. This is the approach most commonly taken before the advent of carbon markets and was the approach in the United States and currently in many places throughout the world. Though, given the uneven distribution of effects of climate change, the SCC *can* vary between countries if the impacts are estimated locally (Ricke, Drouet, & Calderia, 2018).

— The **resource cost of carbon**, which is based on the current cost of abatement. In the Australian context, this is the present value of the spot price for fixed delivery of a tonne of carbon (delivered to the Emissions Reduction Fund, ERF). The average price of a tonne of abatement at the most recent auction (September 2020) was $15.74. Though the particulars of the Australian reverse-auction scheme mean the price is not a reflection of a freely operating market, the British and European governments have recently moved to carbon variations using the resource cost of carbon approach.

These two methods can be roughly described as a demand-price and a supply-price (respectively). In a perfectly operating market — with accurate information, well-defined property rights, and rational decision making — these two prices would be identical and the carbon market would equilibrate. Both approaches introduce uncertainty and inaccuracy for different reasons. However, both approaches have been used in policy contexts and have been upheld in courts in legal contexts.

In line with the ACT Climate Change Strategy Action 5.5 (ensure the social cost of carbon and climate change adaptation outcomes are considered in all ACT Government policies, budget decisions, capital works projects and procurements), for this analysis we have been instructed by the Directorate to use the SCC approach based on estimates from the United States (US) Government's Interagency Working Group (IWG) on Social Cost of Greenhouse Gases. The IWG estimates are based on a frequency distribution for the future costs of climate change per tonne of CO2-e based on climate modelling. The IWG estimates the social costs of carbon for the following scenarios:

— The low scenario shows the average estimate[21] of the future social cost of climate change discounted using a discount rate of 5 per cent.

[21] The average cost of climate change represents the average of the costs estimated from three widely cited integrated assessment models (IAMs) in the peer-reviewed literature. These IAMs estimate global climate

— The medium scenario shows the average estimate of the future social cost of climate change discounted using a discount rate of 3 per cent.
— The high scenario shows the average estimate of the future social cost of climate change discounted using a discount rate of 2.5 per cent.
— The high impact scenario represents higher-than-expected economic impacts from climate change further out in the tails of the social cost of carbon distribution. It uses the social cost of carbon value for the 95th percentile of the frequency distribution of the future costs of climate change discounted at a 3 percent discount rate.

For the central analysis in this RIS we have used the SCC for the medium scenario using a discount rate of 3 per cent based on estimates in Australian dollars produced by Rovingstone Advisory (2021) for the ACT Government (see Table B.4). We have also conducted sensitivity testing using the SCC from the low scenario (at 5 per cent discount rate) and from the high impact scenario given that, as noted by Rovingstone Advisory (p.34), 'current SCC estimates are deemed to be conservative'.

Table B.4 Social cost of carbon estimates, 2020 – 2050 (in Australian 2020 dollars, per tonne of CO2)

Emissions year	Scenario (discount rate and statistic)			
Scenario	**Low**	**Medium**	**High**	**High impact**
Discount rate	**5%**	**3%**	**2.50%**	**3%**
Impacts assumed	**Average**	**Average**	**Average**	**95th percentile**
2020	$20	$71	$104	$207
2025	$24	$77	$114	$232
2030	$27	$84	$123	$255
2035	$30	$92	$131	$282
2040	$35	$101	$141	$307
2045	$39	$107	$149	$331
2050	$44	$116	$160	$356

Source: (Rovingstone Advisory Pty Ltd, 2021)

Avoided electricity network costs

The avoided electricity network costs have been calculated as they were in two recent RISs relating to energy efficiency by:

— imputing a reduction in energy use to a reduction in peak demand using a conservation load factor (CLF)
— quantifying the deferred network benefits by applying a dollar value per unit reduction in peak demand.

We note that a number of assumptions need to be made in applying this approach, but that the savings are secondary benefits compared with saved energy bills or reduced greenhouse gas emissions.

damages using highly aggregated representations of climate processes and the global economy combined into a single modelling framework. The three IAMs were run using a common set of input assumptions in each model for future population, economic, and GHG emissions growth, as well as equilibrium climate sensitivity – a measure of the globally averaged temperature response to increased atmospheric CO_2 concentrations.

Imputing a reduction in peak demand

The most recent RIS for energy efficiency in residential buildings to estimate the reduction in peak demand applied a CLF of 0.4 based on a 2011 SKM MMA (now Jacobs) report and a 2012 Oakley Greenwood/ Marchment Hill report. A Jacobs (2019) report provided the CLFs as set out in Table B.5, which indicate that this figure likely overstates the peak demand reductions (the lower the CLF, the higher the peak demand reductions for a given reduction in energy use).

Based on the CLFs as set out in the 2019 Jacobs report, we have applied a CLF of 0.50.

Table B.5 Conservation load factors

Residential end-use	Basis / Source	Conservation load factor	
		Summer 4 pm peak	Winter 6 pm peak
Building shell upgrade	Summer cooling + Winter heating	0.48	0.50
Residential cooling	RC AC profile	0.48	-
Residential heating	RC AC profile	-	0.50
Residential lighting	Daylight hours & Household occupancy	2.64	0.34
Residential water heating	NZ HEEP study	1.49	1.09
Residential outdoor lighting	Daylight hours & Household occupancy	2.64	0.34
Residential refrigeration	Adjusted cooling profile	0.70	0.90
Televisions and set top boxes	Household occupancy	0.79	0.66
Computers and laptops	Household occupancy	0.79	0.66
Other consumer electronics including mobile chargers, printers et cetera	Household occupancy	0.87	0.73
Other miscellaneous appliances including kettles, toasters, hairdryers, shavers et cetera	Household occupancy	0.83	0.69
Residential pool/spas	Household occupancy, Ergon Energy profile	0.73	0.84

Source: (Jacobs, 2019)

Quantifying the network benefits

The network benefits have been calculated based on the incremental reduction in peak demand in each year and the capital expenditure that would have been avoided by that reduction in peak demand.

The avoided transmission network benefits have been estimated using the same transmission deferral benefit as used in the 2019 Jacobs report ($500/kW), escalated from 2019 dollars to 2020 dollars. This value was:

> *… based on in-house advice and has been chosen because it conservatively reflects the uncertainty associated with network deferrals, and because the value of transmission deferrals is usually not material.*

We have estimated the distribution network benefit using the forecast capital expenditure on load growth in the most recent revenue determinations for each electricity distributor and the forecast growth in peak demand. Based on this data, we have assumed that the costs associated with growing the distribution network are around $3,000/kW, noting that the cost varies widely across electricity distributors as the demand growth is very low or negative in many electricity distribution areas.

Consistent with the 2019 Jacobs report, we have applied a discount factor of 70 per cent to:

> *… allow for the uncertainty involved in networks actually being able to recoup the benefits from the programs.*[22]

Avoided costs of additional renewable energy

The ACT Government has legislated a target to source 100 per cent renewable electricity by 2020. It has undertaken a number of competitive reverse auctions to effectively purchase renewable energy to offset the electricity that is consumed in the ACT to meet the target and more recently to maintain that target.

In the absence of this policy initiative, it is expected that additional auctions will be held to maintain the target over time. The avoided costs of additional renewable energy are the costs avoided by reducing the amount of additional renewable energy that would be purchased to maintain the target over time. These prices have been taken from the previous four quarters of auction results available online.[23] This has been assessed as $14,706 per TJ and assumed to be fixed, in real terms, over the life of the investment.

B.2 Analysis of costs

Similar to the benefits, the proposed minimum standards will impose some costs at the individual (dwelling) level (such as the capital outlays to meet the increased energy efficiency requirements) and some economywide costs. The costs that will be assessed in the analysis are discussed below.

B.2.1 Household costs

As outlined in section 5.1, depending on the policy option analysed, the household costs that are be included in the analysis are:

— Upgrade costs – the cost of any energy efficiency measures installed as a result of the policy (for all policy options) and of any required maintenance/servicing of these upgrades (where relevant), excluding rebates.[24] It is assumed that the resource cost of these upgrades is equal to 90 per cent of the upgrade costs estimated by EES.[25] Resource cost is the opportunity cost

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22 A footnote on page 34 of the Jacobs report indicates that the 70 per cent discount factor was derived from assumptions used in the Department of Climate Change and Energy Efficiency evaluation of a National Energy Saving Initiative.

23 Available here: https://www.environment.act.gov.au/energy/cleaner-energy/renewable-electricity-costs-and-reviews

24 While from a household's perspective it is reasonable to factor any rebates into the cost of installing energy efficiency measures, as a general rule, subsidies are excluded from the economy-wide CBA as, from the societal perspective, they do not represent a resource cost, but just a transfer.

25 The resource cost of different types of construction products varies as there are a number of margins applied throughout the supply chain (e.g. wholesaler and retailer margin and transport margins). A 10 per cent discount on retail costs has been used to approximate the resource cost of construction products based on research by the Reserve Bank of Australia (RBA) that showed that 'the cost of goods accounts for around half of the final sale price of retail items, shared between its two inputs – imports and domestically produced

of allocating resources to the production and installation of the energy efficiency upgrades (instead of some other products or services). In calculating opportunity costs, producer surplus and costs of labour that would otherwise be unemployed are deducted from gross costs. Producer surplus is the difference between what producers are willing and able to supply a good for and the price they actually receive. The upgrade costs are described in more detail in Appendix C.

— DIY – in the case of DIY upgrades, the time taken for the upgrades are added to the upgrade costs. This cost also discounts for the fact that DIY upgrades will not require time to organise upgrades.
— Assessment costs – the cost of the energy efficiency assessment and the time households spend with the assessor during the energy assessment (for a performance-based option). For example, for a ceiling insulation minimum standard, an electrician's assessment has been assumed for all properties prior to upgrading — which aligns with the safety requirements put forward for the EEIS.
— Rectification costs – in the case of ceiling insulation, some properties will not be in a sufficient condition to make the required upgrades. This includes poor or dangerous wiring, pests, or poor quality of the ceiling space.

Learning rates

Learning effects (or learning rates) refer to the rate at which the cost of energy efficiency measures fall over time as a function of:

— industry learning (e.g. building designers can retrofit buildings to achieve a higher energy efficiency standard at a lower cost)
— costs of building materials and energy efficiency products reducing over time as the increased demand leads to economies of scale in production and technological innovation
— labour costs reducing over time as builders become more experienced with applying new building materials, appliances and techniques that may be required to achieve higher energy efficiency.

There are a few studies that discuss learning rates:

— A study by the Moreland Energy Foundation into how the residential buildings sector has responded to the introduction of the 6 star energy efficiency standard found that overall, for both Class 1 and 2 together, an annual learning rate of 7.5 per cent was observed over the 2014-2017 period. Class 1 dwellings alone showed a learning rate of 7.1 per cent per annum over this period, while Class 2 dwellings alone measured 1.7 per cent per annum. However, it is noted that this is based on a very limited sample and is not statistically significant (Moreland Energy Foundation, 2017)
— An evaluation of the Victorian 6 Star Housing Standard for the Department of Environment, Land, Water & Planning highlights the following estimates for lighting equipment:
  – LEDs are estimated to have experienced a learning rate of 28 per cent per year around the middle part of this decade
  – the International Energy Agency notes compact fluorescent lamps as having experienced a 10 per cent learning rate earlier this decade (other sources note higher values in earlier time periods – noting that this technology first emerged in the 1970s). (SPR, 2019)

goods. The remainder reflects the cost of distribution. Splitting this into the various inputs involved in distribution shows that around 20 per cent of the final price is attributable to each of labour and intermediate inputs used by distributors, with the final 10 per cent of the sale price being the net profit of wholesalers and retailers combined'.(D'Arcy P, 2012) available at: https://www.rba.gov.au/publications/bulletin/2012/jun/2.html

- A report by HoustonKemp (2017) advising on the methodology to be used for residential building RISs recommends the following:

  ….a cost efficiency rate of 2 per cent year-on-year as a starting point with sensitivities of 1 per cent (lower bound) and 3 per cent (upper bound). These rates are broadly consistent with what is considered in other sectors, eg, the electricity and gas network sector.

- A 2017 study for the Commonwealth Department of the Environment and Energy reviewed the evidence on learning rates and found that, on average, the prices of energy-related building products had declined only modestly in real terms over the period from 2004 to 2016.(SPR, 2017) Specifically, the real price of a basket of energy-related building products:
  - declined by 0.4 per cent in unweighted terms
  - declined by 0.2 per cent in weighted terms. [26]
- The Low Carbon Living Co-operative Research Centre technical report on building code energy performance which outlines the modelling done for ASBEC's *Built to Perform – An industry led pathway to a zero carbon ready building code* and models the impacts of increased energy efficiency standards for new buildings did not apply learning rates to the prices of building elements used in their modelling. The rationale for doing so was that "while intuitively it is relatively straightforward to posit the existence of learning rates, and to build these into the regulatory benefit-cost analysis, finding hard evidence with which to quantify rates is extremely problematic". (Bannister, 2018)
- The 2018 RIS on the inclusion of heating and cooling energy load limits in NatHERS assessments did not apply a learning rate or change in real costs over time (primarily because most scenarios involved net construction cost savings but also because of the minor nature of the changes involved). (SPR, 2018)
- The 2018 Decision RIS for energy efficiency of commercial buildings in the NCC 2019 (CIE, 2018) did not include learning rates in the central case analysis as they concluded that there was not enough evidence to support a general learning rate *linked to regulatory change.* The RIS also noted that:

  in some circumstances, buildings constructed under the baseline scenario (i.e. constructed under existing NCC minimum requirements) would also benefit from declining prices of building products. Where the price declines for inputs that are used under both the baseline scenario and where stricter minimum performance requirements apply, there would be no change in the incremental cost of achieving higher standards. Even where the price of inputs used to achieve higher standards (but not necessarily under the baseline) falls, lower prices may encourage greater uptake of these products under the baseline. For example, declining prices has encouraged greater uptake of LED lighting even without the need for regulation.

  And that:

  Where cheaper and more energy efficient technologies (and there are no compromises on other characteristics) becomes available (such as LED lighting), they are likely to be adopted by industry even without the need for regulatory change.

Given the above evidence, for the central case analysis in this RIS. The impact of lower costs of upgrades is tested through breakeven analysis.

[26] The basket included over 150 energy-related building elements, including insulation products, glazing, and different kinds of mechanical and electrical plant, including lighting, which were priced by quantity surveyors, Donald Cant Watts Corke.

B.2.2 Administration and enforcement costs

These costs include any additional government resources required to administer and enforce the proposed policy options. These costs could include:

— administration and enforcement costs of the policy
— information campaigns/materials to raise awareness of the changes
— costs of implementation and review.

The costs used for this purpose have been provided by EPSDD and are assumed to be invariant between policy options, though do run for the period of the program. Estimates of Housing ACT organisation costs, which are scaled depending on the requirements of each proposed standard, have been taken from the ACT Public Sector Enterprise Agreement.

B.2.3 Industry costs

Depending on the policy option being examined in the RIS, industry will incur some costs. These could include, for instance, costs associated with training, time required from property managers and insurance requirements.

Costs to real estate agents

Although it is not expected that this will be a 'formal' requirement of the minimum performance standard policy option, it was assumed that real estate agents may be requested to organise for assessments and upgrades. This project management is in excess of organising simple upgrades as is the case with a heater replacement, for example.

In some cases, these costs will be passed through to rental providers, however this time has been estimated separately. This only applies to those properties managed by real estate agents.

For the purposes of this analysis, it was therefore assumed that such a booking would require three hours of a real estate agent's time, based on assumed time required to make phone calls to organise assessments, assist in planning upgrades across multiple providers, and organise payment, etc. This time was costed using the average annual earnings of a real estate agent in ACT (sourced from the ABS).

B.3 Modelling parameters and assumptions

The following sections discuss key inputs and parameters that have been used for the CBA, both at the household and economywide level.

B.3.1 Timeframe for analysis

The analytical timeframe used to model the costs and benefits of the proposed minimum standards is based on the following assumptions about the life of the intervention and of their associated impacts.

The effective life of the intervention

Consistent with best practice and previous CBA analyses, we propose to assume that actions related to the policy (compliance actions, information campaigns, industry training, etc) begin the year the scheme starts (2022) and extend for a period of 10 years (that is, costs associated with the scheme are be modelled for 10 years). After this period, it is assumed that, in a normal cyclical policy review, a new cost-benefit analysis results in the policy being superseded, revised or extended.

The life of the intervention's impact

The benefits that flow from the energy efficiency investments triggered by the policy will depend on the life of the assets installed by householders. Buildings are typically long-lived assets with a life of 40 years or more, whereas appliances are shorter-lived. In light of this, depending on the upgrades required under each policy option, the following assumptions have been used about the expected life of investments.

- Investments related to insulation have been assumed to have an average lifespan of 25 years (the useful life of insulation depends on the type of insulation installed, the R rating of the original insulation, compression and movement over time, and whether any damage has occurred).
- Investments related to heaters have been assumed to have a lifespan of 12 years.
- For performance based minimum standard policy options:
  - Investments relating to upgrades to the building shell have a lifespan of 30 years.
  - Investments related to hot water equipment have been assumed to have a lifespan of 12 years.
  - For investments related to photovoltaics (PV), it was assumed that the panels have a lifetime of 20 years and that inverters (which are integral to the operation of the solar PV panels) last 10 years. It is also assumed that households will replace their inverter in year 11 so that the full 20 year benefits from the panels are realised. Efficiency degradation of PV outputs is not explicitly modelled, instead an average efficiency is used over the panel's lifetime.

B.3.2 Discount rate

There is extensive debate around the basis and selection of the appropriate rate to discount the stream of costs and benefits of interventions related to energy efficiency, as the rate used in CBAs has a very significant impact on the value placed on the benefits accumulated in the future over a long period of time.

The ACT Treasury Guide does not provide for a specific discount rate requirement for RIS. However, the Office of Best Practice Regulation (OBPR) require the calculation of net present values at an annual central real discount rate of 7 per cent, with sensitivity analysis conducted using a lower bound discount rate of 3 per cent and an upper bound discount rate of 10 per cent (OBPR, 2020). Recent energy efficiency Regulation Impact Statements (RISs) related to buildings (CIE, 2018) have used these recommended discount rates, and Houston Kemp in their report *Residential Buildings Regulatory Impact Statement Methodology* (Houston Kemp, 2017) also suggest using these values (although they also suggest reporting evaluation results using a 5 per cent discount rate).

In contrast, a number of countries have used lower discount rates for evaluating policies or regulatory changes associated with energy efficiency or environmental outcomes, for instance:

- The New Zealand Treasury recommends a standard discount rate for all regulatory appraisals of 8 per cent. However, a number of RISs have used lower discount rates when there are environmental or energy efficiency concerns. For example, a RIS for updating energy efficiency regulations for air conditioners used a 5 per cent rate, citing "the value of long term environmental and social benefits associated with energy efficiency". (Houston Kemp, 2017)
- Houston Kemp notes that, in the United States (US), "the Department of Energy recommends using a 3.0 per cent real discount rate (2.5 per cent nominal) for projects relating to energy conservation and renewable energy sources". (Houston Kemp, 2017)
- The Intergovernmental Panel on Climate Change (IPCC) recommends using the following discount rates for projects with long term impacts: a 3.5 per cent discount rate for 1-30 years,

a 3 per cent rate for 31-75 years, a 2.5 per cent rate for 76-125 years, a 2 per cent rate for 125-200 years, 1.5 per cent for 100-300 years, and 1 per cent for a longer period.[27]

For this RIS, we have followed the Directorate's instruction to use a 3 per cent discount rate as the primary comparison rate, reflecting the ACT's commitment to including a social cost of carbon and appropriate discount rate for policies which relate to climate change, and the social and private opportunity cost of the capital investments (and other costs) of a minimum standard. This assumption is the same both at the household and economywide level of analysis. We have also conducted sensitivity analysis using a discount rate of 7 per cent and 10 per cent.

B.4 Net impact

The results of a cost-benefit analysis should be presented so as to facilitate identification of the preferred option. Combining all estimated benefits and costs, we have estimated the net impact of the proposed changes and identify the option that generates the greatest net benefit for the community.

We have provided the following metrics for each policy option:

— Net Present Value (NPV) — the NPV is the sum of the discounted stream of costs and benefits.

— Benefit Cost Ratio (BCR) — the BCR is calculated by dividing the present value of benefits by the present value of costs and can be interpreted as every one-dollar of costs delivers 'X' dollars of benefits.

B.4.1 Sensitivity analysis

Our RIS experience suggests that there is often uncertainty surrounding the values used to estimate potential effects (both future benefits and costs). It is therefore important to conduct a sensitivity analysis to determine the robustness of the parameters used to estimate potential impacts.

The sensitivity analysis allows for variation in the following variables across each of the options:

— the discount rate (discussed briefly)

— energy prices

— the balance between energy efficiency and health impacts

— upgrade costs

— maximum expenditure limits (discussed briefly)

— phase-in rate (implicitly in the scenarios).

The sensitivity analysis is given in section 5.4.

B.4.2 Compliance

The analysis assumes full compliance with the new energy efficiency requirements. While, in reality, not all rental dwellings are likely to comply with the requirements fully, this is a standard assumption in regulatory analysis.

B.4.3 Cost pass-through: distributional impacts and the effect on the rental market via rental providers

The ACT rental market is relatively tight. Since 2005, vacancy rates have been below 2.4 per cent; and over the previous five years, the vacancy rate has been closer to 1 per cent. The effect is that

[27] IPCC, 2007, cited in ASBEC 2016, *Building Energy Performance Standards Project, Issues Paper*, April.

rental providers have power in negotiations. Typically, full cost pass-through is assumed in regulatory impact analyses. In the case of the ACT rental market, the negotiating power of rental providers support this assumption.

However, in 2019, the *Residential Tenancies Amendment Act* was introduced in the ACT. This prevents rental providers from excessive rent increases, and limited rent increases to once per year. This limitation may prevent rental providers from increasing rents to cover capital investments in energy efficiency measures in the short-term. This is particularly if they are not able to make their case through the ACT Civil & Administrative Tribunal (ACAT), which approves rent increases in excess of the prescribed amount.

However, to test the potential impacts to tenants and rental providers of partial and full cost pass-through, we have conducted:

— an analysis of the distributional impacts of the proposed standards with and without full cost pass through
— a case study of a 'typical' or 'average' property with and without a limitation on rent increases. This case study examines the relative cost of the capital investment relative to the after-tax returns for a rental provider. This, represented as a percentage of capital returns, illustrates the annual impact of the returns in the case that rental providers are completely unable to pass through costs.

B.5 Key modelling assumptions

Other key modelling assumptions underpinning the analysis are provided in the tables below:

— Table B.6 Costs, benefits and assumptions included in the CBA model – insulation
— Table B.7 Costs, benefits and assumptions included in the CBA model – heater
— Table B.8 Costs, benefits and assumptions included in the CBA model – performance.

Table B.6 Costs, benefits and assumptions included in the CBA model – insulation

	Item	Related assumptions/notes
Costs		
Households	Cost of energy efficiency upgrades	**Costs incurred by the properties that get upgraded** 1. DIY installations — insulation can be installed by a professional or on a do-it-yourself (DIY) basis. While there is no certainty about the proportion of people that would choose DIY, it has been assumed that 10% of rental providers would choose this option, with 90% choosing to do it through a professional. 2. Organisation and upgrade costs: a) Pre-inspection costs — there are a range of significant risks associated with installing ceiling installation. We assume that, *if the insulation is to be installed by a professional*, the rental property will be inspected by a trained tradesman prior to the installation of ceiling insulation to assess these risks, including the wiring and electrical equipment, accessibility, exposure to hazardous substances (vermin and asbestos), and condition of the ceiling. We assume that the pre-inspection will take one hour at a rate of $100 per hour plus a call out fee of $120. We note that in some cases, rental providers can get free quotes, however, noting that many will not be sure whether work is required or not, we have not assumed this in the modelling. As per the EEIS, EPSDD has directed that an electrician's assessment is required to test the safety of the ceiling space. DIY installations will not incur these costs as it is assumed rental providers check the ceiling and install the batts if needed. b) Pre-installation rectification works — the pre-inspection may identify a range of rectification works that are required to be undertaken prior to the installation of the ceiling insulation to address risks. While some houses will require minimal works, others may need substantial works to, for example, address wiring issues, remove pests, and repair roofs and ceilings. The proportion of houses that would need rectification works and the extent of these works is not known, although some insulation stakeholders noted that there is a small chance of needing substantial work. We assume that, on average, 5 per cent of houses will require some work to be undertaken, with the cost of the works estimated to be, on average $2,000. c) Post inspection — this analysis assumes that the property will be inspected by a trained tradesman following the installation of the insulation to ensure that the installation is safe and meets the requirements. It has been assumed that all properties are inspected, whether: i) they are class 1 or class 2 buildings ii) the installation has been done by a professional or a DIYer. We assume that the post-inspection would take two hours at a rate of $100 per hour plus a call out fee of $120. It would be assumed that a 'certificate' (or similar document) is issued after this inspection, which can be used to demonstrate compliance with the requirements. 3. Time to obtain and organise quotes/works — we have included the opportunity cost associated with the rental provider, property manager or some other party organising quotes – for the supply and installation of insulation where the insulation is installed by a professional and for the supply of insulation where the insulation is installed by a DIYer, and to arrange and attend a pre-inspection (where the insulation is being installed by a professional) and a post inspection. We have assumed that the time required for these activities is three hours where the insulation is being installed by a professional and one and a half hours where the insulation is being installed by a DIYer (reflecting time taken to source materials, rather than sourcing an installer). To value this time, we use the following data and assumptions: a) 92% rental properties are managed by real estate agents and 8% are managed by the owners of the property (as per REIACT) b) the time of real estate agents will be costed using the average annual earnings of a real estate agent in ACT ($35 per hour). As noted above, in some cases, this cost will be passed through to rental providers. However, this is a distributional aspect, rather than pertinent to the net impact of the options. c) the time of property owners will be monetised using estimates of average weekly earnings ($49) from ABS for the ACT.

	Item	Related assumptions/notes
		4. It is assumed that the installation of insulation can occur while the property is rented so it is assumed that there will be no loss in rental income for rental providers. 5. It is assumed that there are no ongoing costs of maintenance/servicing the installed insulation. 6. It is assumed that the costs of insulation remain constant in real terms over the analysis period (i.e. we will not include learning rates in the analysis). 7. It is assumed that rental properties are subject to the policy requirements either: a) For existing (rolling) tenancies, drawing on the Poisson-distribution of tenancy lengths for NSW properties, the cumulative change is given by the (truncated) exponential distribution: i) Year 1: 59% ii) Year 2: 83% iii) Year 3: 100% for the two-year phase-in or 91% for the four-year phase-in iv) Year 4: 95% for the four-year phase-in v) Year 5: 100% for the four-year phase-in b) Upon entering the rental market for the first time, in the absence of information about the number of properties that enter the rental market for the first time every year, it will be assumed that 300 existing properties enter the rental market every year (churn), which stem from the growth of rental properties from 2007-08 to 2017-18 minus newly built properties. For completeness, it will also be assumed that 32% of newly built properties enter the rental market every year — roughly in line with the current proportion of existing rental stock to the total housing stock. These 32% of the new stock do not get upgraded as are assumed to comply with the current energy efficiency requirements for new dwellings set by the National Construction Code. Properties that are upgraded in response to the proposed policy but leave the rental market and are re-rented at later stages will be excluded from the analysis as there is no data about these and are likely to be a small number of properties. 8. For public housing, it is assumed that Housing ACT will upgrade equal parts of the housing stock that needs upgrading in each year of the phase in and that there is zero additional stock that needs upgrading entering the public housing stock after that period (i.e. it is assumed that if new stock is added to public housing, this stock is either new or has been upgraded so that there is no need to upgrade after its acquisition). Housing ACT has plans to replace and expand upon its current housing stock. We have assumed that any new properties entering the portfolio will be sourced such that they meet the proposed standards.
Industry	N/A	Other than the costs for real estate agents of organising the quotes/work (described above), no costs will be included for industry as a result of this policy.
Government	– Administration and enforcement costs – Costs associated with energy efficiency upgrades for public housing	– As per information from the ACT Government the government costs have been assumed to be $400,000 up front costs and $398,474 ongoing costs. The ongoing costs will be depreciated at the same rate as the active upgrades. – Public housing costs have been estimated in a similar manner to private upgrades, however costs are based on the time required for an AOS5 ACT public service wage and is scaled depending on the size of the upgrade program. However, it is assumed that all upgrades are undertaken by a professional (no DIY work).

	Item	Related assumptions/notes
Benefits		
Households	Reduced utility bills accruing from reduced energy use	– Energy savings — the following assumptions will be used in the calculation of energy savings: – Insulation has a lifespan of 25 years, after which the quality of the insulation means it is no longer to the quality of the standards and may have very little benefit in some cases. – 5% of Class 1 rental properties that require insulation cannot physically install it (this is based on ballpark estimates mentioned during consultations with stakeholders), so only 95% of the total 'upgradable' properties will be actually upgraded – two thirds of Class 2 rental properties that require insulation cannot physically install it (only some top floor units can install insulation). So only one third of susceptible properties have been upgraded. – Rebound effect — as noted above, energy savings from implemented energy efficiency measures may not materialise due to the rebound factor. Empirical evidence suggests that the rebound effect is real. However, the evidence also suggests that the magnitude of the effect is highly variable and context specific. Given the uncertainty associated with the rebound factor, we have assessed the energy savings based on a rebound factor of 10 per cent. – As discussed above, the energy savings will be valued using wholesale fuel prices drawing on ACIL Allen's energy market modelling for fuel prices.
	Health benefits	Described in greater detail in appendix section B.1.1.
Society	– Reduced greenhouse gas emissions from household gas use – Reduced renewable energy offsets for the ACT – Avoided electricity network costs – Improved air quality benefits	Described in greater detail in appendix section B.1.1.

Source: ACIL Allen

Table B.7 Costs, benefits and assumptions included in the CBA model – heater

Heading	Item	Related assumptions/notes
Costs		

Households	Cost of energy efficiency upgrades	– It is assumed that there will be no requirement to prove that the rental property complies with the policy (i.e. other than the cost of upgrading the heater -if required- there will be no other compliance costs)
		– It is assumed that the installation of heaters can occur while the property is rented so it is assumed that there will be no loss in rental income for rental providers.
		– It is assumed that the costs of heaters remain constant in real terms over the analysis period (i.e. we will not include learning rates in the analysis).
		– It is assumed that there will be ongoing maintenance costs of $250 per upgraded heater every three years in 45% of properties, which is equivalent to estimates of those existing heaters which do not require regular maintenance (resistance heaters or wood-fire).
		– It is assumed that rental properties are subject to the policy requirements either:
		  – For existing (rolling) tenancies, drawing on the Poisson-distribution of tenancy lengths for NSW properties, the cumulative change is given by the (truncated) exponential distribution:
		    – Year 1: 59%
		    – Year 2: 83%
		    – Year 3: 100% for the two-year phase-in or 91% for the four-year phase-in
		    – Year 4: 95% for the four-year phase-in
		    – Year 5: 100% for the four-year phase-in
		  – Upon entering the rental market for the first time, in the absence of information about the number of properties that enter the rental market for the first time every year, it will be assumed that 300 existing properties enter the rental market every year (churn), which stem from the growth of rental properties from 2007-08 to 2017-18 minus newly built properties. For completeness, it will also be assumed that 32% of newly built properties enter the rental market every year — roughly in line with the current proportion of existing rental stock to the total housing stock. These 32% of the new stock do not get upgraded as are assumed to comply with the current energy efficiency requirements for new dwellings set by the National Construction Code. Properties that are upgraded in response to the proposed policy but leave the rental market and are re-rented at later stages will be excluded from the analysis as there is no data about these and are likely to be a small number of properties.
		– Time to obtain and organise quotes/works — we have included the opportunity cost associated with the rental provider, property manager or some other party organising quotes – for the supply and installation of insulation where the insulation is installed by a professional and for the supply of insulation where the insulation is installed by a DIYer, and to arrange and attend a pre-inspection (where the insulation is being installed by a professional) and a post inspection. We have assumed that the time required for these activities is three hours where the insulation is being installed by a professional and one and a half hours where the insulation is being installed by a DIYer (reflecting time taken to source materials, rather than sourcing an installer). To value this time, we use the following data and assumptions:
		  – 92% rental properties are managed by real estate agents and 8% are managed by the owners of the property (as per REIACT)
		  – the time of real estate agents will be costed using the average annual earnings of a real estate agent in ACT ($35 per hour). As noted above, in some cases, this cost will be passed through to rental providers. However, this is a distributional aspect, rather than pertinent to the net impact of the options.
		  – the time of property owners will be monetised using estimates of average weekly earnings ($49) from ABS for the ACT.

Heading	Item	Related assumptions/notes
		– For public housing, it is assumed that Housing ACT will upgrade equal parts of the housing stock that needs upgrading in each year of the phase in and that there is zero additional stock that needs upgrading entering the public housing stock after that period (i.e. it is assumed that if new stock is added to public housing, this stock is either new or has been upgraded so that there is no need to upgrade after its acquisition). Housing ACT has plans to replace and expand upon its current housing stock. We have assumed that any new properties entering the portfolio will be sourced such that they meet the proposed standards.
Industry	Time to obtain and organise quotes/works	Other than the costs for real estate agents of organising the quotes/work (described above), no costs will be included for industry as a result of this policy.
Government	– Administration and enforcement costs – Costs associated with energy efficiency upgrades for public housing	– As per information from the ACT Government the government costs have been assumed to be $400,000 up front costs and $398,474 ongoing costs. The ongoing costs will be depreciated at the same rate as the active upgrades. – Public housing costs have been estimated in a similar manner to private upgrades, however costs are based on the time required for an AOS5 ACT public service wage and is scaled depending on the size of the upgrade program. However, it is assumed that all upgrades are undertaken by a professional (no DIY work).
Benefits		

Households	Reduced utility bills accruing from reduced energy use	– Energy savings — the following assumptions have been used in the calculation of energy savings:
		  – Space heaters have a lifespan of 12 years.
		  – All Class 1 rental properties that require a heating upgrade can physically install it
		  – 10% of Class 2 rental properties that need to upgrade heating to comply with the policy cannot physically install it. This reflects those apartments which do not have access to an outside space for a heat pump unit.
		  – Rebound effect — as noted above, energy savings from implemented energy efficiency measures may not materialise due to the rebound factor. Empirical evidence suggests that the rebound effect is real. However, the evidence also suggests that the magnitude of the effect is highly variable and context specific. Given the uncertainty associated with the rebound factor, we have assessed the energy savings based on a rebound factor of 10 per cent.
		  – As discussed above, the energy savings are valued using wholesale fuel prices drawing on ACIL Allen's energy market modelling for fuel prices.

	Health benefits	Described in greater detail in appendix section B.1.1.
Society	– Reduced greenhouse gas emissions from household gas use	Described in greater detail in appendix section B.1.1.

Heading	Item	Related assumptions/notes
	– Reduced renewable energy offsets for the ACT – Avoided electricity network costs – Improved air quality benefits	

Source: ACIL Allen

Table B.8 Costs, benefits and assumptions included in the CBA model – performance

Heading	Item	Related assumptions/notes
Costs		
Households	Cost of energy efficiency upgrades	– It is assumed that rental properties are subject to the policy requirements either: – For existing (rolling) tenancies, drawing on the Poisson-distribution of tenancy lengths for NSW properties, the cumulative change is given by the (truncated) exponential distribution: – Year 1: 59% – Year 2: 83% – Year 3: 100% for the two-year phase-in or 91% for the four-year phase-in – Year 4: 95% for the four-year phase-in – Year 5: 100% for the four-year phase-in – Upon entering the rental market for the first time, in the absence of information about the number of properties that enter the rental market for the first time every year, it will be assumed that 300 existing properties enter the rental market every year (churn), which stem from the growth of rental properties from 2007-08 to 2017-18 minus newly built properties. For completeness, it will also be assumed that 32% of newly built properties enter the rental market every year — roughly in line with the current proportion of existing rental stock to the total housing stock. These 32% of the new stock do not get upgraded as are assumed to comply with the current energy efficiency requirements for new dwellings set by the National Construction Code. Properties that are upgraded in response to the proposed policy but leave the rental market and are re-rented at later stages will be excluded from the analysis as there is no data about these and are likely to be a small number of properties. – For public housing, it is assumed that Housing ACT will upgrade equal parts of the housing stock that needs upgrading in each year of the phase in and that there is zero additional stock that needs upgrading entering the public housing stock after that period (i.e. it is assumed that if new stock is added to public housing, this stock is either new or has been upgraded so that there is no need to upgrade after its acquisition). Housing ACT has plans to replace and expand upon its current housing stock. We have assumed that any new properties entering the portfolio will be sourced such that they meet the proposed standards. **Costs incurred by all rental properties subject to the new standards** 1. Cost of the energy efficiency assessment — the cost per assessment is based on the following information and assumptions used on our analysis for the Commonwealth of the extension of NatHERS ratings to existing homes: – based on the Victorian Residential Energy Scorecard (RES) experience, the cost of assessment for houses in Victoria is the average of $300 and $500 (i.e. $400) – it is be assumed that: – the assessment cost for Class 2 is 80 per cent of the cost for Class 1 – the real cost of the assessments would decline by a total of 10 per cent over ten years (this was based on the assumption that assessors would become more efficient at undertaking the assessments due to natural learning over time) – the cost of rating public housing dwellings is the same as the cost of rating a private dwelling. Practically, it may be possible for Housing Act to work with its existing facilities management contracts to undertake assessments and management, though for impact modelling purposes, this is assumed to be the same cost.

Heading	Item	Related assumptions/notes
		2. Rating certificate validity period – a single assessment will be required for the ten-year period. Rental providers will not be required to make multiple assessments if they have one completed. **Costs incurred by the properties that get upgraded** 3. Verification costs — Under a scorecard arrangement, options to meet performance targets are provided by the assessor. Proof of work (e.g. photographs or receipts) which can be provided to the original assessor (to their satisfaction) may be sufficient to verify that the required upgrades to meet the performance standard have been undertaken. Accordingly, we assume $100 additional cost for those properties which have made upgrades to certify that a property is now meeting standards. 4. Time to obtain and organise quotes/works — we have included the opportunity cost associated with the rental provider, property manager or some other party organising quotes for a performance option. We have assumed that the time required for these activities is three hours. To value this time, we use the following data and assumptions: a) 92% rental properties are managed by real estate agents and 8% are managed by the owners of the property (as per REIACT) b) the time of real estate agents will be costed using the average annual earnings of a real estate agent in ACT ($35 per hour). As noted above, in some cases, this cost will be passed through to rental providers. However, this is a distributional aspect, rather than pertinent to the net impact of the options. c) the time of property owners will be monetised using estimates of average weekly earnings ($49 per hour) from ABS for the ACT. 5. Loss of rental income — only a small proportion of properties will need investments in shell upgrades which would make a property unrentable, for example, having windows removed to be replaced. This loss of rental income stems from an inability to attract/advertise, rather than from driving tenants from the property during the upgrade period. Based on industry consultation, almost all upgrades under this option will be completed under 2 days. We have assumed that 20% of properties will lose two days of the median weekly rental income (approximately $150) for the upgrades required to meet the proposed standards, recognising that multiple elements of work will be required for some properties. 6. It is assumed that there are no *additional* ongoing costs of maintenance/servicing other than for heaters. 7. It is assumed that there will be ongoing maintenance costs of $250 per upgraded heater every three years in those properties which will require replacing of an existing heater. 8. It is assumed that the costs of upgrades remain constant in real terms over the analysis period (i.e. we will not include learning rates in the analysis). 9. It is assumed that there will be no residual value of existing equipment replaced to meet the requirements.
Industry	Time to obtain and organise quotes/works	– It is assumed that an assessor can conduct 200 assessments per year. – Each assessor will require 1.5 weeks for training to deliver a Scorecard-like performance assessment. This training is costs are 1.5 weeks of the annual salary for a building assessor in the ACT. – Each assessor will require insurance for the period they are conducting performance assessments, which is only required in those years they are active.
Government	– Administration and enforcement costs – Costs associated with	– As per information from the ACT Government the government costs have been assumed to be $400,000 up front costs and $398,474 ongoing costs. The ongoing costs will be depreciated at the same rate as the active upgrades. – Public housing costs have been estimated in a similar manner to private upgrades, however costs are based on the time required for an AOS5 ACT public service wage and is scaled depending on the size of the upgrade program. However, it will be assumed that all upgrades are undertaken by a professional (no DIY work).

Heading	Item	Related assumptions/notes
	energy efficiency upgrades for public housing	
Benefits		
Households	Reduced utility bills accruing from reduced energy use	– Energy savings — the following assumptions will be used in the calculation of energy savings: – Space and water heaters have a lifespan of 12 years – Solar PV have a lifespan of 20 years, inverters have a lifespan of 10 years and need to be replaced – Shell upgrades have a lifespan of 30 years. – All properties can be upgraded (there are no technical exemptions) – Rebound effect — as noted above, energy savings from implemented energy efficiency measures may not materialise due to the rebound factor. Empirical evidence suggests that the rebound effect is real. However, the evidence also suggests that the magnitude of the effect is highly variable and context specific. Given the uncertainty associated with the rebound factor, we have assessed the energy savings based on a rebound factor of 10 per cent. As discussed above, the energy savings will be valued using wholesale fuel prices drawing on ACIL Allen's energy market modelling for fuel prices.
	Health benefits	Described in greater detail in appendix section B.1.1.
Society	– Reduced greenhouse gas emissions from household gas use – Reduced renewable energy offsets for the ACT – Avoided electricity network costs – Improved air quality benefits	Described in greater detail in appendix section B.1.1.

Source: ACIL Allen

C Housing stock model

C.1 Modelling tool overview

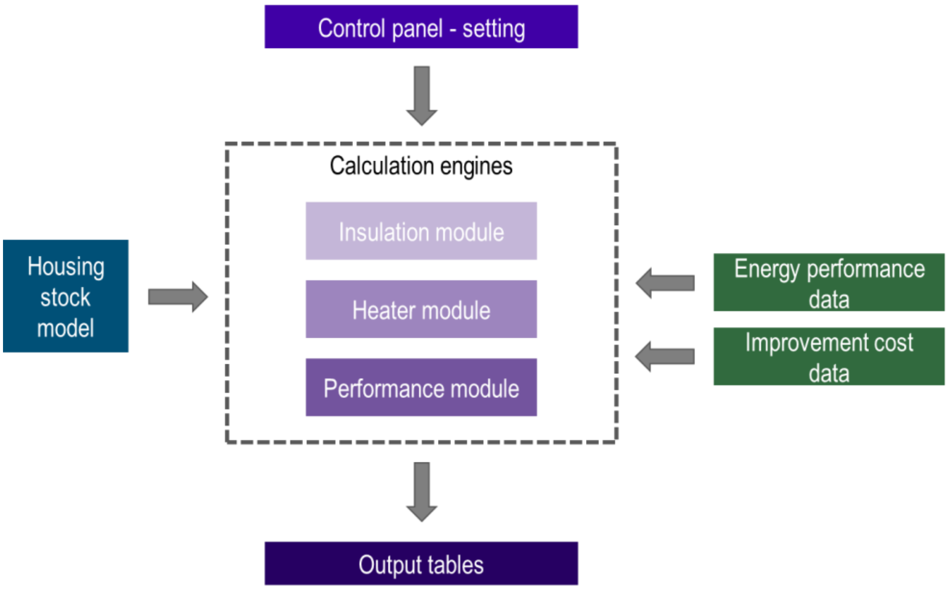
The modelling tool developed for this project is in the form of a MS-Excel spreadsheet. The modelling tool has been set up to discretely model three regulatory scenarios in respect of ACT rental stock:

— upgrades to ceiling insulation
— upgrades to heating equipment
— whole of house performance upgrades (based on the Victorian Scorecard tool).

The model contains 7 main components as follows (see also Figure C.1, below)

— a stock model of housing in the ACT
— a stock model of ceiling insulation
— a stock model of heating equipment
— a stock model of whole of house performance levels (based on Vic Scorecard ratings)
— energy performance data
— improvement cost data.

Figure C.1 Schematic of housing stock evaluation model



Source: Energy Efficient Strategies

The housing stock model is common to all evaluations. The regulatory impacts are assessed in the ceiling insulation, heating equipment and whole of house performance modules. In these modules the housing stock is disaggregated into various categories or “performance cohorts”. For example, in the case of insulation, the stock is categorised into a range of representative cohorts, dwellings with no ceiling insulation, dwellings with sub-optimal insulation (less than R2), dwellings with R3 installed, dwellings with R4 installed and dwellings with R5 installed. Each of these cohorts within the stock is ascribed a propensity — how much of the housing stock they make up — for the year 2020 based on available data.

In each year following 2020 a user of the model can set a proportion of a particular cohort to be upgraded in that year. For example, in 2022 25 per cent of the stock of dwellings with no ceiling insulation might be expected to be upgraded to R5 ceiling insulation under a particular regulatory scenario and this process might continue for the following 3 years such that by the end of 2025 all dwellings without ceiling insulation at the start of the period are now insulated. Effectively the model simply transfers numbers of dwellings from one type (uninsulated) to another type (R5 insulated).

The model also has a facility to place a cap on the maximum proportion of a cohort that can be upgraded for practical reasons. For instance, in the case of ceiling insulation in class 1 dwellings a small proportion would be expected to have inaccessible ceiling spaces and in the case of Class 2 dwellings only those on the uppermost floor would need to have ceiling insulation fitted (i.e. only one in four of all the flats in a four storey block).

Finally, the model can also track two other stock change phenomena:

— the flow of stock between rental and non-rental property types (or visa-versa)
— the flow of new stock into the market (i.e. stock built post 2020).

The flow of stock between non rental and rental (or visa-versa) can have an impact on the total number of upgrades undertaken and the duration of the upgrade process. For example, if after a 4 year initial period of upgrade of all existing rental stock (i.e. 100 per cent of the potential rental stock that could be upgraded has been upgraded) further stock then flows from the non-rental market into the rental market then a proportion of that stock would be expected to meet the requirement for upgrade (i.e. no ceiling insulation or sub-optimal ceiling insulation) and this would be expected to be upgraded upon entry into the rental market.

The flow of new stock into the rental market has been included in the stock model to ensure that all stock is factored into the overall housing stock accounting of the model. However, in terms of the policy options examined in this study, this cohort is not expected to require any upgrading. Being new stock it would already have ceiling insulation (R4 at a minimum), meet a 6-star NatHERS performance level and would presumably have a heater type installed during construction that met the regulatory requirements examined in this study.

For each performance cohort that makes up the housing stock, estimates of energy usage by fuel type were made (see following sections of this report for details relating to energy performance assumptions). By multiplying the per-dwelling energy use (in relation to the particular upgrade option) by the number of that performance cohort in each year, the annual total energy consumption by fuel type is calculated. To gauge the impact of the regulations in energy terms, it is then simply a matter of comparing the annual energy consumption of the “with regulations” case with the annual energy consumption of the “without regulations” or BAU case for each year impacted by those regulations.

The model also takes into account significant changes in the stock over time. This is most apparent in the case of heaters where there is an ongoing shift from gas technologies to heat pump technologies over time with this transition expected to be complete by about 2050. However, as the proposed regulations only require that gas heaters of more than 20 years of age be replaced this underlying trend is expected to have a similar (but not identical) effect on both the BAU case and the with regulations case.

The following sections provide further details and assumptions in relation to the model including:

— C.2 – ACT Housing stock model
— C.3 – Insulation upgrades
— C.4 – Heating upgrades
— C.5 – Performance based standards.

C.2 ACT Housing stock model

For this study the housing stock was divided into four categories of housing:

1. Non-social housing – Class 1: private standalone houses
2. Non-Social Housing – Class 2: private multiunit dwellings
3. Social Housing – Class 1: public standalone houses
4. Social Housing – Class 2: public multiunit dwellings.

The starting point for the housing stock model was the total number of dwellings (rental and non-rental) in the ACT in 2020 with projections to 2035. These values were derived from ABS data (Household and Family Projections, Australia, 2011 to 2036, 2015) and are shown in Table C.1.

Table C.1 ACT Housing stock projections

Year	Total stock
2020	165,873
2021	168,924
2022	172,020
2023	175,115
2024	178,218
2025	181,352
2026	184,501
2027	187,673
2028	190,865
2029	194,076
2030	197,325
2031	200,585
2032	203,816
2033	207,069
2034	210,324
2035	213,589

Source: Energy Efficient Strategies

Census data was used to split the stock into NCC Class 1 and Class 2 components.[28] In 2020 the split was approximately 85 per cent Class 1 and 15 per cent Class 2. However, because more than 45 per cent of all newly built housing in the ACT is now Class 2 (based on ABS approvals data – this is however expected to decline in coming years) the proportion of the stock that is class 2 is

[28] Available at: https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/6?opendocument

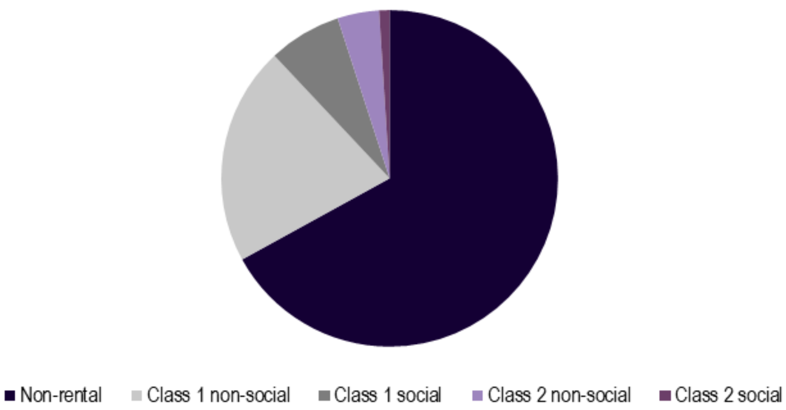
expected to rise over the coming years to approximately 23 per cent by 2035. This trend is however not expected to impact significantly on the regulatory outcomes as noted earlier the regulations are not expected to impact newly built stock.

ABS data was also used to determine the split between rental and non-rental housing stock.[29] The split was found to be almost exactly one-third rental and two-thirds non rental. There was no readily available disaggregation by class of dwelling, so this split was assumed to apply equally to both Class 1 and Class 2 dwellings.

In the rental market, the split between social and non-social housing was derived from Housing Assistance in Australia (The Australian Institute of Health and Welfare - June 2020). Social housing represented 23.27 per cent of all rental housing. A split between Class 1 and Class 2 dwellings was provided by Housing ACT, Community Services Directorate with 52.7 per cent being Class 1 and 47.3per cent Class 2.

For 2020 the profile of the ACT Housing stock is represented in Figure C.2.

Figure C.2 ACT Housing stock profile, 2020



Source: Energy Efficient Strategies

C.3 Insulation upgrades

C.3.1 Overview

Two regulatory options were modelled in relation to ceiling insulation:

— Option A: Rental homes with less than R2 ceiling insulation are required to install/upgrade to a minimum of R3 with a phase in period.

— Option B: Rental homes with less than R2 ceiling insulation are required to install/upgrade to a minimum of R5 (or maximum possible where R5 is not possible) with a phase in period.

In both of these options there are potentially two types of base case that exhibit significantly differing performance characteristics. There are those dwellings with no pre-existing ceiling insulation whatsoever and those that have some insulation but less than R2 (i.e. sub-optimal insulation). Those with no pre-existing insulation whatsoever will gain the most significant performance boost as a result of the retrofit of ceiling insulation. This cohort is however significantly smaller than the sub-optimal cohort that will achieve a lesser performance gain compared to the no pre-existing insulation cohort.

[29] Available at: https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/8ACTE?opendocument

For the analysis it was estimated based on professional judgement that 90 per cent of Class 1 dwellings with less than R2 ceiling insulation would be practical to insulate and that 25 per cent of Class 2 dwellings with less than R2 ceiling insulation would be practical to insulate (noting that only apartments on the uppermost level of a block of apartments need to be insulated). These assumed limits of practicality can easily be adjusted in the model if required.

C.3.2 Stock categorisation

As noted in the previous section, for the purposes of insulation retrofitting the housing stock was divided into 5 categories or cohorts as follows:

1. R0 - Pre 1992 (applies to part of the stock built before insulation regulations came into force)
2. 0<R<2 - Pre 1997 (applies to part of the stock built before ACTHERS came into force)
3. R3 - 1997 – 2005 (Estimate of average level of insulation applied under ACTHERS – 4 Star requirement)
4. R4 - 2006-2009 (Estimate of average level of insulation applied under NCC – 5 Star requirement)
5. R5 - 2010-2021 (Estimate of average level of insulation applied under NCC – 6 Star requirement).

Upgraded stock was drawn from the first 2 cohorts and was upgraded (transferred) to either R3 (third cohort) or R5 (fifth cohort).

C.3.3 Stock profile

A profile of the stock in terms of the cohorts noted in the previous section was developed based on stock age profiling in the ACT undertaken for the Victorian Scorecard project that utilised ABS stock age profiling from ABS 4182: 1999 as well as stock number profiling from the study Energy Use in the Australian Residential Sector 1986:2020 (DEWHA, 2008) and profiling contained in the ICANZ Study: The Value of Ceiling Insulation (Energy Efficienct Strategies, 2011). These are best estimates only as there is a fair degree of uncertainty (e.g. significant numbers of “unknown” responses in ABS survey data relating to the presence of ceiling insulation and no survey data whatsoever in relation to actual R values in the field) regarding these values. No information is available that separates the insulation propensity of rental properties from owner-occupier properties.

Table C.2 Propensity of ceiling insulation, Canberra housing stock

Ceiling insulation category	Approximate era	Estimated propensity today
R0	Pre 1992	10%[a]
0<R<2	Pre 1997	31%[b]
R3 Existing	1997 - 2005	32%[c]
R4 Existing	2006-2009	6%[c]
R5 Existing	2010-2021	22%[c]

[a] Largely based on ABS survey estimates of ceilings with no ceiling insulation.
[b] Includes all housing built pre 1992 (53%), less those with no insulation at all (10%) multiplied by approximately 70% for an assumed BAU rate of upgrade of approximately 1% per annum since 1992 when ceiling insulation regulations were first introduced in the ACT.
[c] Based on the number of dwellings built in that era.
Source: Energy Efficient Strategies

The expected thermal performance characteristics of housing is based on analysis undertaken for the ACT EEIS scheme for detached dwellings.

For class 2 dwellings reference was made to The Victorian Housing Stock Performance Model (DEWLP, 2018). This model includes a comparison for the performance of detached and flats in the Canberra climate zone (NatHERS CZ 24 which is also found in select parts of Victoria). Comparing the average heating and cooling loads of detached dwellings with flats for climate zone 24 it was found that the heating loads associated with flats was 90 per cent of that of detached dwellings and the cooling loads 66 per cent. These percentage reduction factors were applied to the detached dwelling performance levels as developed for the ACT EEIS scheme.

The impact of reduced heating and cooling loads stemming from the retrofit of insulation will depend to a large degree on the type and efficiency of space conditioning equipment installed in ACT dwellings. For the analysis of the impacts of insulation upgrades on actual heating and cooling energy consumption a heating and cooling equipment profile as described in section C.4.3 and C.4.4 was used.

Table C.3 Thermal Performance Characteristics of Ceiling Insulation Type, $MJ/m^2/yr$

	Class 1			Class 2		
Ceiling Insulation	Heating	Cooling	**Total**	Heating	Cooling	**Total**
R0	763.0	168.8	**931.8**	689.4	110.9	**800.3**
0<R<2 (R0.5)[a]	469.0	73.0	**542.0**	423.8	47.9	**471.7**
R3	410.0	64.4	**474.4**	370.4	42.3	**412.8**
R4	386.4	61.0	**447.4**	349.1	40.1	**389.2**
R5	380.8	60.1	**440.8**	344.0	39.4	**383.5**

[a] Insulation between zero and R2 would normally be expected to average a level of R1. However, in line with the approach taken in the EEIS scheme the actual performance level for this cohort was assumed to be R0.5. This de rating is predicated on the basis that these installations would all be at least 30 years old and, in many cases, would be expected to no longer be continuous over the entire ceiling space. Such discontinuity would arise due to poor initial installation practice, disturbance of the insulation layer due to retrofit of down-lighting and other forms of minor renovation involving the ceiling area and the impact of vermin.

Source: Energy Efficient Strategies

C.3.4 Costs

To establish likely costs or ceiling insulation retrofit a limited survey was undertaken of three suppliers – Bunnings, Insulation Depot and Pricewise. The result of that survey is shown in Table C.4.

Table C.4 Insulation costs – various sources

R Rating	Coverage	Price ($)	$/m²
3	**70.7**	**15.47**	**$4.57**
3	55.81	10.8	$5.17
5	**45.72**	**5.4**	**$8.47**
5	71.3	7.4	$9.64
5	75	7.5	$10.00
5	55	5.49	$10.02
5	62.88	6.1	$10.31
5	46.66	4.5	$10.37

Source: Energy Efficient Strategies

Lowest available costs from the survey were taken and added to this was a $5/m² installation cost giving total installed costs as follows:

— R3 = $4.57 + $5.00 = $9.57

— R5 = $8.47 + $ 5.00 = $13.47

Note: For under insulated ceiling spaces it may be possible to re-use the existing insulation and lay new insulation over the top (top up insulation). In this way it may be possible to use lower grade insulation e.g., if the existing insulation was rated at R1.0 and the target insulation level was R5.0 then top up insulation would only need to be rated at R4.0 rather than R5.0. In reality however, often the pre-existing insulation is in poor condition and non-continuous over the ceiling area, in which case the old insulation is either typically removed first, or if left in place is covered by insulation that is rated at the target level.

C.4 Heating upgrades

C.4.1 Overview

Proposed regulatory requirement

Rental homes without a fixed heater must install a minimum 1.5 star fixed electric heat pump heater that can heat the living area with a phase-in period.

Rental homes with fixed resistance electric heater/s or a resistance electric concrete slab heater must be replaced with a minimum 1.5 star fixed electric heat pump heater that can heat the living area with a phase in period.

Other heaters in rental homes must be replaced at end of life or, if demonstrably older than 20 years, within the phase in period, by a minimum 1.5 star fixed electric heat pump heater electric that can heat the living area.

It is assumed that in class 1 type dwellings there would be no limitation on the installation of a heat pump type heater. However, it is recognised that in class 2 type dwellings such an installation may be unfeasible due to physical constraints (e.g. no space to locate an external unit of a heat pump type heater or due to limitations imposed by a body corporate). A limitation of 90 per cent upgradable was placed on Class 2 dwellings, this is an estimate only as no data source on this aspect is readily available.

C.4.2 Stock categorisation

To undertake modelling of this particular upgrade activity the existing stock of heating equipment within the ACT was divided into eight main types known to exist in the housing stock. These were:

— central gas (primarily ducted gas)
— central heat pump (primarily ducted heat pump)
— room gas
— room heat pump (primarily reverse cycle split systems)
— central electric resistance panel heaters
— firewood (primarily closed combustion type heaters)
— electric floor slab heating
— no heating (i.e., no fixed heating).

Each of these categories was divided into two parts, units less than 20 years old and units more than 20 years old. Gas, heat pump and firewood heaters of 20 years of age or more are tracked separately in the model because they must be upgraded in the phase in period. Each year a portion of the existing stock will turn 20 years old and at that point in time will be required to be replaced

Four further categories of heat pump were also modelled:

— new central heat pumps (separate from regulations)

— new room heat pumps (separate from regulations)
— replacement central heat pumps (replaced as a consequence of the regulations)
— replacement room heat pumps (replaced as a consequence of the regulations).

New central and new room heat pumps are those installed in newly built rental properties or those installed as part of the natural trend away from gas heating to heat pump heating. This trend is assumed to be approximately 3 per cent per annum (i.e. full change over by approximately 2050). These installations are assumed to meet the regulatory requirement.

Replacement central and replacement room heat pumps represent the heat pumps installed as a consequence of the proposed regulations.

C.4.3 Stock profile

A stock profile of the propensity of each of the heater types modelled was developed based on research undertaken for the Victorian Scorecard extension into the ACT by the Department of Environment, Land, Water and Planning in Victoria. These values are shown in the second column of Table C.5. The third and fourth columns indicate the propensities of heater types going into new housing in the ACT based on recent analysis undertaken by EES for the NCC 2022 update. Heaters going into new housing are however generally of limited interest as they would not be upgraded under this program (i.e. neither 20 years old or of the types required to be upgraded).

The estimates in respect to the cohort of 20 year old stock is made on the basis of an assumed average life of 12 years for space heating equipment (as per EEIS assumptions). Given a normal distribution about the mean average life of 6 years, the proportion of the stock expected to be of 20 years of age or more would be approximately 1 per cent of the total of that type of heater.

Table C.5 Propensity of Heating and Cooling Types – ACT

Type	Stock	New Class 1	New Class 2
Heating			
Central Gas	28.2%	5.6%	2.0%
Central HP	10.5%	0.0%	0.0%
Room Gas	8.4%	1.4%	2.0%
Room HP	42.2%	0.0%	0.0%
Central Elec Panels	2.6%	0.0%	0.0%
Firewood	3.5%	2.5%	0.0%
Slab	2.6%	0.0%	0.0%
No Heating	1.0%	0.5%	1.0%
Central Gas - 20 YO	0.3%	0.0%	0.0%
Central HP - 20 YO	0.1%	0.0%	0.0%
Room Gas - 20 YO	0.1%	0.0%	0.0%
Room HP - 20 YO	0.4%	0.0%	0.0%
Electric Panels - 20 YO	0.0%	0.0%	0.0%
Firewood - 20 YO	0.0%	0.0%	0.0%
Slab - 20 YO	0.0%	0.0%	0.0%
No Heating - 20 YO	0.0%	0.0%	0.0%
New Central HP	0.0%	18.0%	13.3%
New Room HP	0.0%	72.0%	81.7%

Type	Stock	New Class 1	New Class 2
Replacement Central HP	0.0%	0.0%	0.0%
Replacement Room HP	0.0%	0.0%	0.0%
Cooling [a]			
No cooling	27%	3%	2%
Central HP (Cool)	14%	18%	13%
Central evaporative	15%	2%	0%
Room HP (Cool)	44%	77%	84%

[a] Cooling data is included in this table, however, it is not used in the heating activity calculations. Cooling data is however used in relation to the insulation activity and is therefore relevant in respect of that activity – see appendix section *C.3*.

Source: Energy Efficient Strategies

C.4.4 Performance characteristics

Performance characteristics of the various heater types are shown in Table C.6 below. Under this table are notes relating to the basis for these estimates.

Table C.6 Performance Characteristics of Heating and Cooling Types - ACT

Type	Efficiency	Losses	Zoning Constraint (Class 2)	Main Fuel
Heating				
Central Gas	0.75	20%	0.7	Gas
Central HP	2.4	20%	0.7	Electricity
Room Gas	0.73	0%	0.3 (0.55)	Gas
Room HP	2.4	0%	0.3 (0.55)	Electricity
Central Elec Panels	1	0%	0.7	Electricity
Firewood	0.65	0%	0.7	Firewood
Slab	1	15%	0.7	Elec (Controlled)
No Heating	1	0%	0.7	Electricity
Central Gas - 20 YO	0.675	25%	0.7	Gas
Central HP - 20 YO	2.16	25%	0.7	Electricity
Room Gas - 20 YO	0.657	0%	0.3 (0.55)	Gas
Room HP - 20 YO	2.16	0%	0.3 (0.55)	Electricity
Electric Panels - 20 YO	1	0%	0.7	Electricity
Firewood - 20 YO	0.6	0%	0.7	Firewood
Slab - 20 YO	1	15%	0.7	Elec (Controlled)
No Heating - 20 YO	1	0%	0.7	Elec (Controlled)
New Central HP	3	15%	0.7	Electricity
New Room HP	3	0%	0.3 (0.55)	Electricity
Replacement Central HP	3	15%	0.7	Electricity
Replacement Room HP	3	0%	0.3 (0.55)	Electricity

Type	Efficiency	Losses	Zoning Constraint (Class 2)	Main Fuel
Cooling [a]				
No cooling	1	0%	0	Electricity
Central HP (Cool)	4.116	20%	0.7	Electricity
Central evaporative	15	20%	0.9	Electricity
Room HP (Cool)	4.466	0%	0.3 (0.55)	Electricity

[a] Cooling data is included in this table, however, it is not used in the heating activity calculations. Cooling data is however used in relation to the insulation activity and is therefore relevant in respect of that activity – see *appendix section* C.3.

Source: Energy Efficient Strategies

Notes Regarding the above tables:

1. The performance assumptions relating to heating and cooling equipment stock (excluding 20 year old stock) match those assumed in the EEIS scheme except that in the case of heat pumps the performance assumptions have been downgraded (approximately 80 per cent) to reflect more accurately the expected performance when rated according to the GEMS 2019 determination that applies seasonal rating principles. In the case of cooling performance, the performance assumptions have been upgraded (approximately 140 per cent) to reflect more accurately the expected performance when rated according to the GEMS 2019 determination that applies seasonal rating principles.
2. Heat pump, gas and firewood heating equipment of 20 years of age is assumed to have a performance level of 10 per cent worse than the general stock. There is no expected degradation in the performance of resistance electric type heating equipment.
3. Duct losses have been assumed to be 20 per cent for the general stock and 30 per cent for 20 year old stock (the EEIS scheme assumed 25 per cent for all existing stock). New equipment entering the stock is subject to minimum performance requirements under the NCC 2019 and as such is expected to suffer losses of only 15 per cent.
4. Zoning constraints account for the fact that capacity limits associated with some heater types (particular room type heaters as distinct from central type heaters) mean that not all of the dwelling can be heated. In the case of central heating a maximum of 70 per cent of the dwelling is assumed to be heated with some utility, service and corridor areas assumed to be excluded.

C.4.5 Costs

No comprehensive survey data was readily available for the cost of supply and install of heating equipment in the ACT. Reference was instead made to the Sustainability Victoria Zero Net Carbon model study (Sustainability Victoria, 2021) that surveyed a space conditioning equipment supply and install companies to estimate costs across the range of space conditioning equipment as well as across a range of efficiency levels (noting that some space conditioning equipment only comes in a single efficiency level (e.g. resistance electric heating).

The results of that analysis are detailed in the following charts (see Figure C.3, Figure C.4, Figure C.5 & Figure C.6) that include the specifications of the derived cost curves. These cost curves describe the cost of supply and installation per m^2 of floor area serviced. The following three space conditioning types were found to have a fixed cost per m^2:

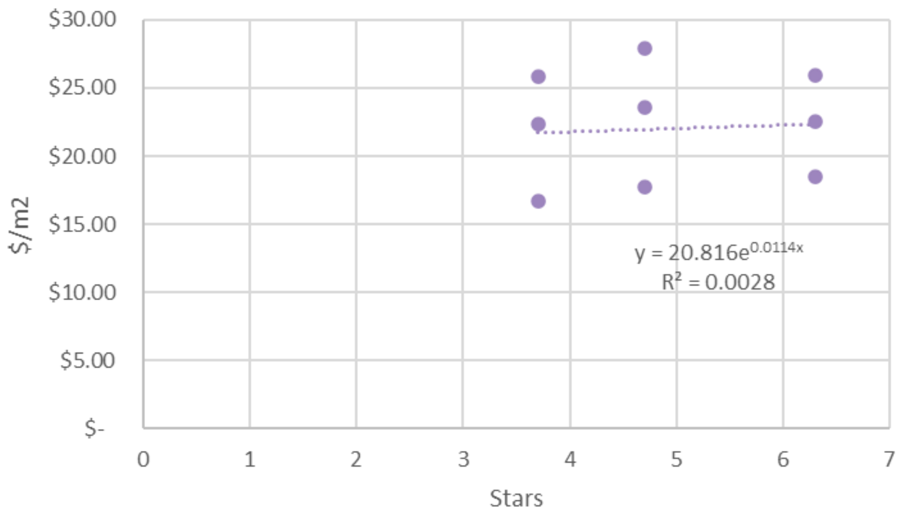
— electric panel heating – \$22.27 / m^2

— floor slab heating – \$72.00 / m^2

— wood fired slow combustion heating – \$17.28 / m^2.

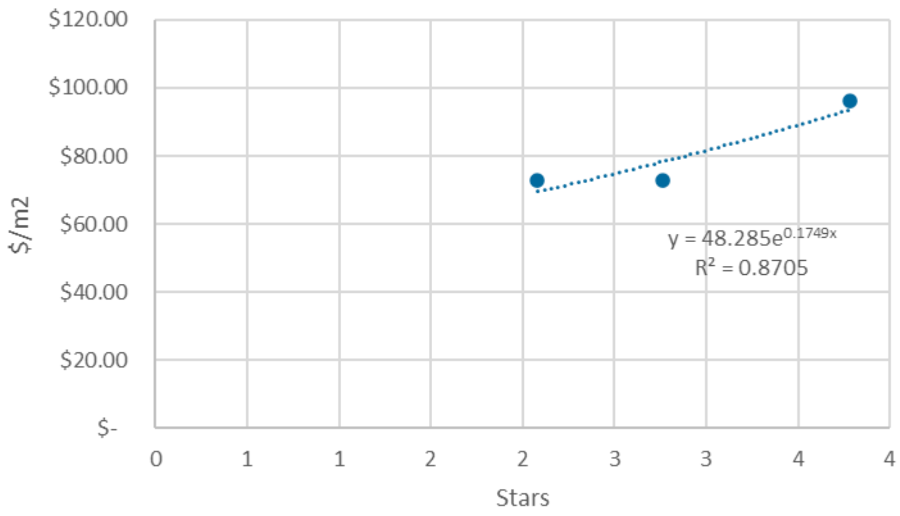
Costs were adjusted to account for differences in building costs when comparing Victoria and the ACT (100 per cent) as well as for building cost price increases since 2016 (113 per cent). The net impact of these two factors was a 13 per cent increase in costs over and above that assumed in the Sustainability Victoria Zero Net Carbon study.

Figure C.3 Cost curve analysis for selected space conditioning equipment – central gas ducted



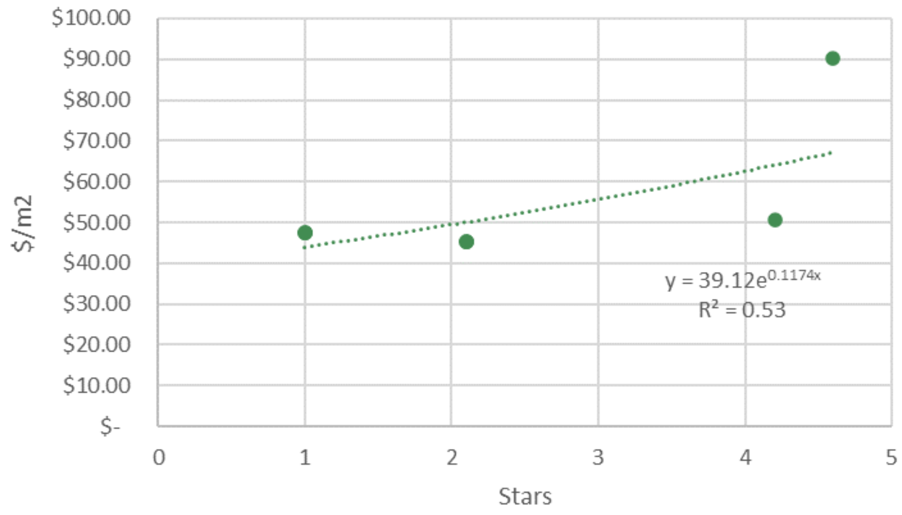
Source: Energy Efficient Strategies

Figure C.4 Cost curve analysis for selected space conditioning equipment – central ducted reverse cycle



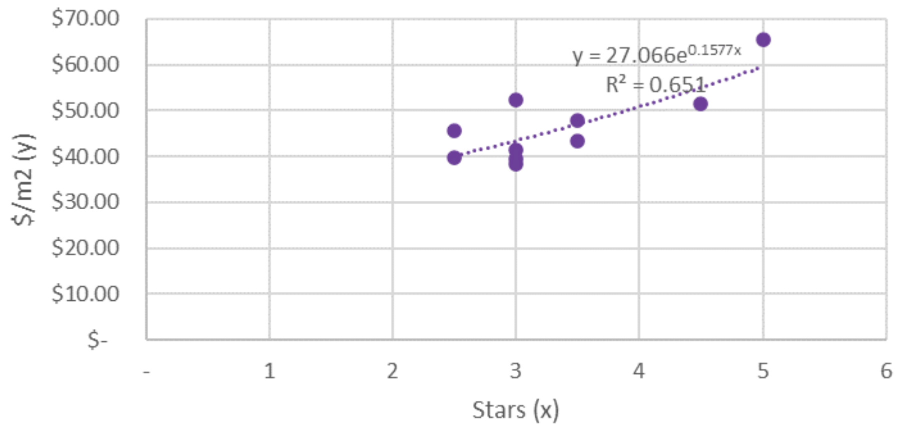
Source: Energy Efficient Strategies

Figure C.5 Cost curve analysis for selected space conditioning equipment – room gas



Source: Energy Efficient Strategies

Figure C.6 Cost curve analysis for selected space conditioning equipment



Source: Energy Efficient Strategies

C.5 Performance-based upgrades

C.5.1 Overview

Proposed regulatory requirement

— Option A: Rental properties rated as 1 star or less must be upgraded to at least 2 stars with a phase in period.

— Option B: Rental properties rated as 2 stars or less must be upgraded to at least 3 stars with a phase in period.

The performance requirement refers to the Victorian Residential Efficiency Scorecard (the Scorecard) rating scheme.

This scheme is not as yet available in the ACT although some pilot trials have been undertaken. The scorecard tool uses operational running cost per dwelling as the basis for rating purposes. This means that a dwelling with high operational costs will score poorly and one with low operational costs will score well. High operational costs are usually indicative of poorly performing building shells, inefficient appliances and or a lack of on-site renewable energy supply (typically PV installations).

The scorecard has a rating scale from 1 to 10 stars (technically a dwelling can score zero stars, but the minimum rating awarded is 1 star where its energy consumption is more than 300 per cent of a 3 star level)). Stars are graded as a percentage of the 3 star level which designates an average energy cost for the particular jurisdiction.

Whilst some work has been done to establish what the 3 star rating level should be in the ACT there are some clear underestimates in the analysis (average heating energy cost is assumed to be less than average hot water energy cost for instance). To get a more realistic estimate of the expected 3 star level, reference was made to a previous analysis undertaken by EES for another study. Using the residential household energy use model developed for that study, the weighted average energy cost for an ACT dwelling was found to be $1,950 per annum. This is somewhat less than a value of just under $2,100 cited in the most recent AER survey of energy costs by jurisdiction. Each of the other star ratings are estimated as a percentage of the 3 star level. The application of the AER value of $2,100 to the 3 star band level results in a star band scale as shown in the far right hand column of Table C.7.

What this assumed star band arrangement would mean in terms of the proposed regulations is that:

— Option A: Rental properties rated as 1 star or less (rated operational cost of more than $4,200) must be upgraded to at least 2 stars (rated operational cost of $4,200 or less).
— Option B: Rental properties rated as 2 stars or less (rated operational cost of more than $2,100) must be upgraded to at least 3 stars (rated operational cost of $2,100 or less).

Table C.7 Victorian Scorecard rating basis for the ACR

Scorecard Star Rating	Percentage of 3 star rating	Annual Operating Cost[a]
1	300%	$6300
2	200%	$4200
3	**100%**	$2100
4	75%	$1575
5	60%	$1260
6	45%	$945
7	30%	$630
8	15%	$315
9	0%	$0
10	-13%	$-273

[a] Values based on previous analysis undertaken by EES for another study.

Source: Energy Efficient Strategies

C.5.2 Stock categorisation

All stock was categorised according to its expected Scorecard rating as determined via reference to the stock profile developed for a previous model developed by EES for another study i.e:

— 1 Star
— 2 Star
— 3 Star
— 4 Star

— 5 Star
— 6 Star
— 7 Star
— 8 Star
— 9 Star
— 10 Star.

Within the actual model only the relevant cohorts were assessed:

— 2 Star Minimum: BAU = Less than 2 Star, Upgraded = 2 star
— 3 Star Minimum: BAU = Less than 3 Star, Upgraded = 3 star.

All existing cohorts equal to or above a 3 Star rating were simply ignored as the regulations would not impact on these cohorts.

C.5.3 Stock profile

Based on analysis undertaken by EES for an unpublished study, the existing stock profiles are estimated to be as shown in Table C.8. For class 2 dwellings there are no dwellings of less than 2 stars rating, this means that for class 2 dwellings the first regulatory option (upgrade to 2 stars) would not be applicable (only class 1 dwellings would be affected). The other noteworthy aspect is that the proportion of the stock that is less than 2 stars is relatively small (i.e. limited scope for upgrades) whereas the proportion of the stock that is less than 3 stars is relatively large (i.e. significant scope for upgrades).

Table C.8 Propensity of Existing ACT Housing - Victorian Scorecard Rating Basis

Scorecard Star Rating	Propensity – Class 1	Propensity – Class 2
0	0.2%	0.0%
1	6.6%	0.0%
2	42.7%	10.9%
3	27.3%	24.0%
4	15.6%	42.0%
5	4.9%	21.0%
6	2.2%	2.1%
7	0.4%	0.0%
8	0.00%	0.0%
9	0.00%	0.0%

Source: Energy Efficient Strategies

C.5.4 Performance characteristics

Performance characteristics of the various cohorts were derived from a residential household energy use model previously developed by EES. Upgrade pathways were selected on the basis of the least cost pathway, noting however that only a limited range of typical upgrade options were available from that study including upgrades to building shell, heaters, coolers, hot water systems and the addition of renewable energy supply (PVs).

Table C.9 Class 1 average annual energy consumption (MJ) by star rating cohort

Star Rating	Electrical Peak	Electrical Controlled	Gas	Firewood	PV Offset	PV Export
< 2 Star	15,873	6,022	104,670	-	-341	-475
2 Star	15,159	6,022	92,614	-	-6,591	-9,498
< 3 star	18,289	7,928	47,243	2,068	-513	-773
3 Star	17,560	6,095	31,664	1,922	-7,299	-10,381

Source: Energy Efficient Strategies

Table C.10 Class 2 average annual energy consumption (MJ) by star rating cohort

Star Rating	Electrical Peak	Electrical Controlled	Gas	Firewood	PV Offset	PV Export
< 3 star	16,999	-	34,028	-	-	-
3 Star	14,448	-	29,098	-	-4,155	-8,547

Source: Energy Efficient Strategies

C.5.5 Upgrade costs

Using a model previously developed by EES for another study, an assessment was undertaken on the costs associated with an upgrade to either 2 stars or 3 stars. This assessment included the capital value of any building shell enhancement plus equipment capital costs plus PV and inverter capital costs.

On average the costs were as follows:

— upgrade to 2 stars = $4,620

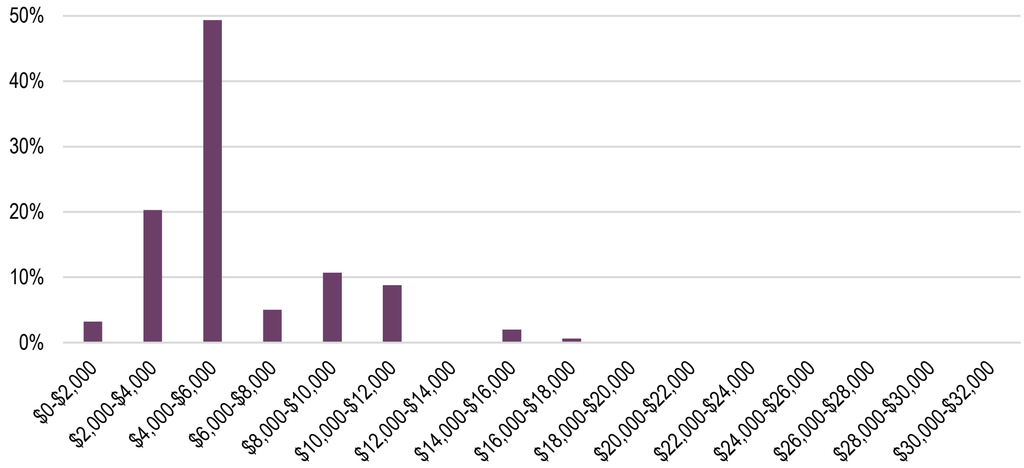
— upgrade to 3 stars = $ 8,450.

There was however a wide distribution of costs across the range of dwelling configurations modelled. Some dwellings needed to do very little to make the performance target whilst others (generally those with very low star ratings) had to undertake more significant upgrades. The distributions of cost are shown in Figure C.7 (2 star target) and Figure C.8 (3 star target).

It should be noted that these costs include for the full cost of any heating, cooling or hot water equipment being replaced irrespective of the age of the pre-existing equipment. Significantly lower costs would be applicable if the extended lifespan of the newly installed equipment (compared to the incumbent equipment) were taken into account (existing equipment would on average be half-way through its lifespan) or alternatively if the requirement was such that equipment must only be replaced at the end of its life. Additionally, the cost of some improvement measures such as upgrading to a heat pump type water heater have been dropping significantly in the past few years.

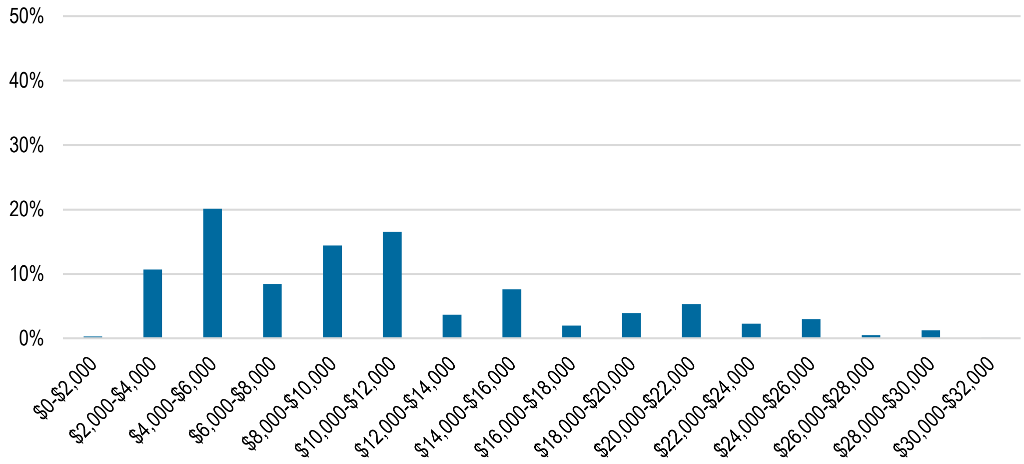
Furthermore, the range of improvement options examined for this performance-based method were by necessity somewhat limited. For some dwellings there are likely to be a range of lower cost alternative solutions not covered by the model. In consideration of these various factors, the cost estimates for this improvement measure as reported above have a discount factored in of 20 per cent to account for the noted limitations and conservative nature of the model.

Figure C.7 Distribution of costs to upgrade to 2 stars



Source: Energy Efficient Strategies

Figure C.8 Distribution of costs to upgrade to 3 stars



Source: Energy Efficient Strategies

C.6 Greenhouse gas intensity of fuels

The model developed for this project has been set-up so as to be able to model a total of three fuel types as follows:

— electricity
— mains gas
— firewood (or solid fuels).

Electricity and mains gas are by far the most significant with firewood holding onto a moderate market share in regional areas of the southern states.

Electricity is divided into 3 tariff groups.

— peak
— controlled load
— PV feed-in.

Greenhouse Gas Intensity Factors have generally been taken from the values developed for the EEIS scheme.

C.6.1 Greenhouse gas intensity of fuels

The greenhouse gas intensity of electricity is set to zero to reflect the ACT government policy in relation to the greenhouse gas intensity of the ACT electricity supply.

The greenhouse gas intensity for gas is based on National Greenhouse Account Factors 2019 - Scope 1 + Scope 3.

The greenhouse gas intensity for firewood is based on estimates prepared by George Wilkenfeld and Associates for the Commonwealth in relation to closed combustion type heaters.

A summary of the assumed greenhouse gas intensity of fuels is contained in Table C.11.

Table C.11 Greenhouse gas intensity of fuels (tonnes/MJ)

Tariff type	Greenhouse Gas Intensity (Tonnes/MJ)
Electricity	0
Elec (Controlled)	0
Gas	0.0000643
Firewood	0.0000013
PV Offset	0
PV Export	0

Source: Energy Efficient Strategies

ACIL Allen energy market models

D

This Appendix provides an overview of two of our energy market models that were used to provide inputs to our cost benefit analysis:

— *PowerMark*, which simulates the wholesale electricity market
— *GasMark*, which simulates the wholesale gas market.

D.1 PowerMark

PowerMark has been developed over the past 20 years in parallel with the development of the National Electricity Market (NEM). *PowerMark* is a complex model with many unique and valuable features. It provides insights into:

— wholesale pool price trends and volatility
— variability attributable to weather/outages and other stochastic events
— market power and implications for generator bidding behaviour
— network utilisation and generation capacity constraints
— viability of merchant plant and regional interconnections
— contract and price cap values
— timing, size and configuration of new entrant generators
— demands for coal, gas and other fuels; and
— the cost outlook for buyers of wholesale electricity.

PowerMark effectively replicates the Australian Energy Market Operator's (AEMO's) settlement engine — the SPD engine (scheduling, pricing and dispatch). This is achieved through the use of a large-scale linear programming (LP)-based solution incorporating features such as quadratic interconnector loss functions, unit ramp rates, network constraints and dispatchable loads. The veracity of modelled outcomes relative to the AEMO SPD has been extensively tested and exhibits an extremely close fit.

In accordance with the NEM's market design, the price at any one period is the cost of the next increment of generation in each region (the shadow or dual price within the LP). The LP seeks to minimise the aggregate cost of generation for the market as a whole, while meeting regional demand and other network constraints. Figure D.1 is a simplified diagrammatic representation of the model and its methods of combining input data from the supply and demand modules to produce a price and dispatch result for each region and power station for each period.

PowerMark is very flexible. Additional elements, such as regions, interconnectors, generators or loads can be easily added and their characteristics varied through time. *PowerMark* has been applied to several different market designs — gross pools, net pools, regional and nodal structures.

A distinctive feature of *PowerMark* is the inclusion of a portfolio optimisation module. This component which is almost always employed when modelling energy-only markets, allows selected portfolios to seek to maximise net revenue positions (taking into consideration contracts for differences) for each period. These modified generator offers are then resubmitted to the settlement engine to determine prices and dispatch levels. Each period is iterated until a convergence point (based on Nash-Cournot / Supply Function equilibrium theory) is found.

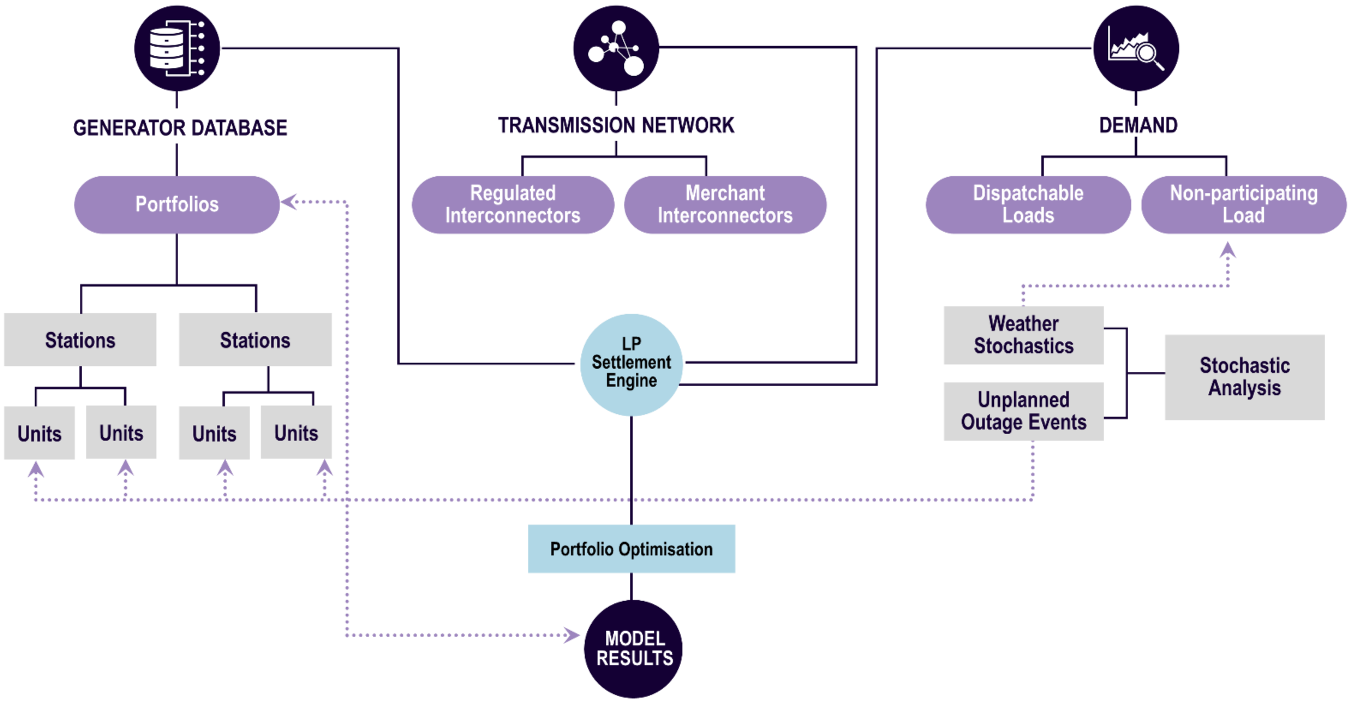
The benefits of the optimisation module are twofold:

— portfolios structure their generation offers in an economically rational way. From past experience, this optimisation process generates strategies which align with the behavioural reality in the marketplace; and

— second-round effects from fundamental changes to the market — such as a policy change, addition or closure of generators, transmission augmentation or creation of additional regions, can automatically be incorporated without imposing explicit constraints or directions for incumbents.

PowerMark can be configured to run at varying time intervals — from 5 minutes (288 period days) through to 180 minutes (8 period days). Typically, the model is run hourly or half-hourly to meet client requirements and establish a reasonable price resolution.

Figure D.1 PowerMark model structure



Source: ACIL Allen

D.2 GasMark

GasMark Global (GMG) is a generic gas modelling platform developed by ACIL Allen. GMG has the flexibility to represent the unique characteristics of gas markets across the globe, including both pipeline gas and LNG. Its potential applications cover a broad scope — from global LNG trade, through to intra-country and regional market analysis. *GasMark Global Australia* (GMG Australia, or *GasMark*) is an Australian version of the model which focuses specifically on the Australian market (including both Eastern Australia and Western Australia), but which has the capacity to interface with international LNG markets.

The model can be specified to run at daily, monthly, quarterly or annual resolution over periods up to 30 years.

D.2.1 Settlement

At its core, *GasMark* is a partial spatial equilibrium model. The market is represented by a collection of spatially related nodal objects (supply sources, demand points, LNG liquefaction and receiving facilities), connected via a network of pipeline or LNG shipping elements (in a similar fashion to 'arks' within a network model).

The equilibrium solution of the model is found through application of linear programming techniques which seek to maximise the sum of producer and consumer surplus across the entire market simultaneously. The objective function of this solution, which is well established in economic theory[30], consists of three terms:

— the integral of the demand price function over demand; minus

— the integral of the supply price function over supply; minus

— the sum of the transportation, conversion and storage costs.

The solution results in an economically efficient system where lower cost sources of supply are utilised before more expensive sources and end-users who have higher willingness to pay are served before those who are less willing to pay. Through the process of maximising producer and consumer surplus, transportation costs are minimised and spatial arbitrage opportunities are eliminated. Each market is cleared with a single competitive price.

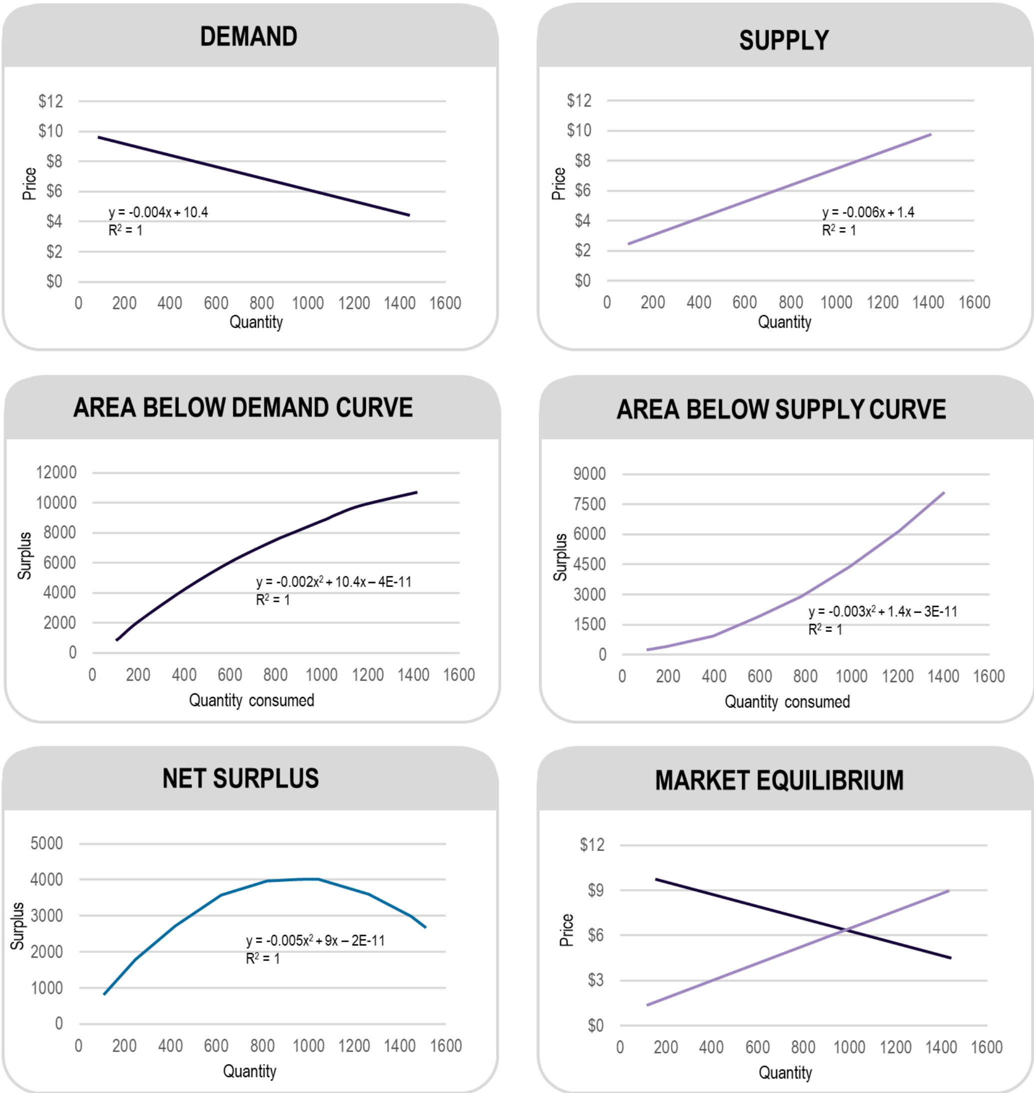
Figure D.2 seeks to explain diagrammatically a simplified example of the optimisation process. The two charts at the top of the figure show simple linear demand and supply functions for a market. The figures in the middle of Figure D.2 show the integrals of these demand and supply functions, which represent the areas under the demand and supply curves. These are equivalent to the consumer and producer surpluses at each price point along the curve. The figure on the bottom left shows the summation of the consumer and producer surplus, with a maximum at a quantity of 900 units. This is equivalent to the equilibrium quantity when demand and supply curves are overlayed as shown in the bottom right figure.

The distinguishing characteristic of spatial price equilibrium models lies in their recognition of the importance of space and transportation costs associated with transporting a commodity from a supply source to a demand centre. Since gas markets are interlinked by a complex series of transportation paths (pipelines, shipping paths) with distinct pricing structures (fixed, zonal or distance based), GMG Australia also includes a detailed network model with these features.

Spatial price equilibrium models have been used to study problems in a number of fields including agriculture, energy markets, mineral economics, as well as in finance. These perfectly competitive partial equilibrium models assume that there are many producers and consumers involved in the production and consumption, respectively, of one or more commodities and that as a result the market settles in an economically efficient fashion. Similar approaches are used within gas market models across the world.

30 The theoretical framework for the market solution used in GMG is attributed to Nobel Prize winning economist Paul Samuelson.

Figure D.2 Simplified example of market equilibrium and settlement process



Source: ACIL Allen

D.2.2 Data inputs

The user can establish the level of detail by defining a set of supply regions, customers, demand regions, pipelines and LNG facilities. These sets of basic entities in the model can be very detailed or aggregated as best suits the objectives of the user. A 'pipeline' could represent an actual pipeline or a pipeline corridor between a supply and a demand region. A supplier could be a whole gas production basin aggregating the output of many individual fields or could be a specific producer in a smaller region. Similarly, a demand point could be a single industrial user or an aggregation of small consumers such as the residential and commercial users typically serviced by energy utility companies.

The inputs to GMG Australia can be categorised as follows:

— **Existing and potential new sources of gas supply**: these are characterised by assumptions about available reserves, production rates, production decline characteristics, and minimum price expectations of the producer. These price expectations may be based on long-run marginal costs of production or on market expectations, including producer's understandings of substitute prices.

— **Existing and potential new gas demand**: demand may relate to a specific load such as a power station, or fertiliser plant. Alternatively, it may relate to a group or aggregation of customers, such as the residential or commercial utility load in a particular region or location. Loads are defined in terms of their location, annual and daily gas demand including daily demand profiles, and price tolerance.

— **Existing, new and expanded transmission pipeline capacity**: pipelines are represented in terms of their geographic location, physical capacity (which may vary over time), flow characteristics (uni-directional or bi-directional) and tariffs.

— **Existing, new and expanded gas storage facilities**: Storage is represented in terms of geographic location, physical capacity (which may vary over time), injection and withdrawal rates, storage efficiency and tariffs.

— **Existing and potential new LNG facilities**: LNG facilities include liquefaction plants, regasification (receiving) terminals and assumptions regarding shipping costs and routes. LNG facilities play a similar role to pipelines in that they link supply sources with demand. LNG plants and terminals are defined at the plant level and require assumptions with regard to annual throughput capacity and tariffs for conversion.

E Stakeholder views

As part of the development of this RIS, ACIL Allen undertook a comprehensive series of consultations with a variety of stakeholders, including internal representatives from across the ACT Government — for example areas responsible for safety, sustainability, and rental regulation. Not all potentially impacted individuals could be consulted, though we endeavoured to find representatives of as many groups as possible.

The stakeholder engagement process involved thirteen interviews and workshops, a survey (see Appendix F), as well as direct submissions on the proposed reforms. The external stakeholders engaged represent or advocate for rental providers, tenants, industry, and community organisations. Some of the consulted organisations, such as CHC Australia, Care Financial Counselling and the Real Estate Institute ACT (REIACT) work with both rental providers and tenants. Those stakeholders that contributed their views are included in Figure E.1.

Figure E.1 External stakeholders

Rental providers & advocates

- Owners Corporation Network of the ACT
- Ratepayers Association of the ACT
- CHC Australia
- Housing ACT
- Law Society of the ACT property law committee
- Individual rental providers

Tenants & advocates

- The Tenant's Union ACT
- Legal Aid ACT – Tenant Advice Service
- Canberra Community Law
- Care Financial Counselling
- Individual tenants

Community advocates

- ACT Council of Social Services
- St Vincent de Paul
- ACT Shelter
- Better Renting
- Conservation Council ACT

Industry

- Real Estate Institute ACT
- Insulation Australasia
- Australian Building Sustainability Association
- Master Electricians Australia
- Insulation Council of Australia & New Zealand
- National Electrical and Communications Association

Source: ACIL Allen

E.1 Views on the proposed options

There was no unanimously preferred option between a roof ceiling standard, an energy-efficient heater standard, or a performance-based standard across all groups consulted. Even within groups, there was no strong preference for one option over others. No group consistently dis-preferred any option, though they recognised that implementation was important across options.

That said, there were some consistent messages (within engagements and across engagements) about the options:

- Features-based standards (such as roof insulation or an energy efficient heater) are simpler for rental providers to comply with. A performance-based measure would provide more flexibility for rental providers.
- There are other minimum standards, such as safety, that could be more important than energy-efficiency or thermal control in the short-term.
- The existing energy-efficiency improvement scheme overlaps in goal and coverage with the proposed standards and should be run in a coordinated manner with the standards.
- A heater-based standard is likely to *increase* energy use while insulation and a performance-based standard are more likely to decrease energy use. Partly for this reason, a heater-based standard may not be desirable without first investing in insulation and draught proofing.
- A less imposing standard (such as a feature-based standard) is preferred in the short-term, while more expansive standards (such as a performance-based, or multiple feature-based standards) should be a longer-term goal.
- Implementation decisions will be highly impactful on the outcomes of any proposed standards.
- The thermal control features of a rental property are only one factor affecting energy consumption, and that the other part is tenant behaviours. Multiple stakeholders described it as 80 per cent features, 20 per cent behaviour.
- Draught-proofing may be a simpler option, though would be more difficult to regulate and enforce.
- Window coverings are an additional simple option, that can also provide privacy benefits for tenants.
- No option will fit all properties and all circumstances.

E.2 Views on impacts on tenants

Stakeholders unanimously recognised that tenants would be the beneficiaries of the minimum standards. It is expected that they will benefit through both comfort, reduced energy bills, and health improvements. In the workshop with tenants' advocates, it was pointed out that there could be a myriad of benefits across different tenant groups including, for example: less lost time to illness, better mental health, less sick days for workers, less budget pressures for tenants, and tenants who are willing to remain in a property for longer (more stability for tenants and rental providers).

Several factors were identified across stakeholder that might decrease the net benefit to tenants. These include:

- The impacts of the standards on the rental market (see section E.4 for more details):
  - most stakeholders recognised that upgrades have the potential to increase rents. It was pointed out that some older tenants in the community are already paying rents up to the maximum available under the aged pension scheme and might not have the capacity to deal with additional rental increases. One stakeholder pointed out that, even with increased rental costs, regular small additional amounts paid through increased rent would still be preferable to lumpy quarterly energy bills in many cases.
  - rental providers groups pointed out that where rental properties are withdrawn from the market, tenants as a group will suffer the consequences in terms of lower housing availability.

— Energy costs — stakeholders identified that in some cases where a heater is installed in a property or insulation makes heating more attractive, there is a potential for increased energy use and therefore energy bills.

E.3 Views on impacts to private rental providers

Stakeholders noted that cost impacts on rental providers would stem primarily from up-front capital costs and compliance costs. Benefits for rental providers would be realised for some through improvements in rental income or capital gains. Individual rental providers and organisations that represent their interests reacted strongly against minimum standards, asserting that costs impacts could be significant and unbearable for some rental providers — with implications for the rental market (see section E.4). Several written submissions from individual rental providers were emphatic that any additional burden would make their investment untenable.

Both property managers and rental providers groups identified that the burden can be two-fold, and for some rental providers may be significant:

— effects on rental returns for rental providers

— the regulatory burden of meeting additional requirements.

While there may be some burden on some rental providers, some stakeholders also noted that the regulation may also provide some benefit to some rental providers.

E.3.1 Costs to rental providers

The financial impact on rental providers was a primary concern. For some properties, improving energy efficiency performance by the equivalent of several stars was viewed as having upfront costs in the tens-of-thousands of dollars. One rental provider noted that raising their property to the equivalent of four stars would require substantial demolition and rebuilding. For some rental providers their investment is either a primary source of income or represents their 'nest-egg'.

Effects on rental returns

Investments in upgrades necessarily add to the costs of the property and may not add equally to the returns. Where increased rents cover the cost of the upgrades, and provide a return to rental providers, it should improve rental returns. However, views across stakeholders were mixed as to whether rental providers would be able to pass through costs to tenants. For those rental providers not able to recuperate additional investments, it would decrease rental returns.

Rental providers own and provide rental properties for a diversity of reasons. However, few do so without regard for rental returns. Rental providers highlighted that, to invest in a rental property, a rough 3 per cent annual return is required to make this investment comparable to the returns generated by other investment assets.

Rental provider groups highlighted the regulatory context in which minimum standards are being introduced. Recent regulatory changes to the residential rental sector, such as the *Residential Tenancies Amendment Act 2019*, as well as changes to land-taxes have all negatively impacted rental returns for some rental providers.

Liquidity constraints

Multiple stakeholders drew a distinction between active investors and "mum and dad" rental providers. The distinction was used, especially to refer to the capacity for rental providers to make up-front investments into their properties. Representatives of property managers, as well as financial counsellors pointed out that the cost of operating a rental property can be unmanageable for some rental providers without any additional costs from minimum standards. The additional costs imposed by a minimum standard can be beyond the liquidity constraints of some of these types of investors, and in some cases can cause mortgage stress related to their existing investments.

E.3.2 Regulatory burden

Organisations that represent rental providers pointed out that the regulatory burden placed on rental providers has increased in recent years. They noted that the 2019 reforms to the rental market increased the regulatory burden and removed property rights for rental providers. Based on information provided by the property managers they represent, REIACT , stated that about 85 per cent of sales from rental providers to owner-occupiers since the 2019 reforms can be attributed to the additional regulatory burden associated with the reforms — though there is no evidence that sales of rental properties have increased over the period. Rental provider groups highlighted that any regulatory standards would be in addition to the existing burden faced by rental providers.

Some rental providers and their representatives highlighted that any minimum energy efficiency standards would be a further erosion of property rights over their rental properties, and that they would have purchased properties with a particular set of property rights which would be very different to those after the proposed minimum standards are introduced.

E.3.3 Benefits to rental providers

It was noted in several workshops that there are a number of potentially beneficial impacts for rental providers, which can positively affect returns for rental providers:

— Greater tenant retention in comfortable houses. For instance, tenants who come from other areas who are unfamiliar with Canberra's climate often choose to move tenancies after the initial lease period to find a more comfortable home.

— Greater security of income. For some rental properties, improved energy efficiency will result in reduced bills which has the potential to alleviated financially-stressed household budgets. As a result, for some rental providers, they will secure more reliable rental incomes.

— Capital appreciation. Investments in thermal comfort and energy efficiency make properties more appealing to buyers. As a result, some rental providers will garner some capital appreciation from investments in the property.

E.4 Views on impacts to the rental market

A prominent theme throughout the consultation process was the potential impacts on the rental market. Canberra's rental market is tight, with a very low vacancy rate, especially for houses.

In the context of this tight market, there was a view across stakeholders that a minimum standard had the potential to increase the burden on rental providers, which could result in fewer rental properties, higher rental prices or both. It was acknowledged across meetings that the impacts will be varied across different segments of the rental market.

E.4.1 Views on housing availability in the private market

REIACT provided an important insight on the challenging real estate market for tenants: for some properties, there is a turn-around of only two days between tenants — only enough time to clean and inspect a property before new tenants commence a lease. REIACT pointed out that the shortage is particularly acute for lower cost rental properties and in houses, both of which are the most likely to be affected by minimum standards. This was corroborated by tenants' bodies which pointed out that there is already a severe shortage for both short-term and long-term rental properties; and there is a severe crisis in the availability of public and social housing.

Given demand is already in excess of supply in many segments of the rental market, the additional burden placed on rental providers will ultimately be the determining factor on whether minimum standards will further limit housing availability. As noted above, the burden can be financial — by way of the effect of returns — or the additional burden of meeting regulatory requirements.

Both organisations that represent rental providers and REIACT indicated that both of these factors will drive some rental providers to sell rental properties and withdraw supply from the market. As noted above, according to REIACT, approximately 85 per cent of sales of rental properties over 2020 stemmed from increased regulatory burden — especially as a result of the 2019 reforms to the rental market. If the case, this amounts to several thousand properties across Canberra, a substantial portion of the rental market.

Impacts on rental returns could likewise drive rental providers to sell properties and leave the market. Organisations representing rental providers pointed out that, for some investors, returns falling below three per cent will drive them to switch their investment to other asset classes where they could reach this return. REIACT and Care Financial Counselling suggested that some groups of investors would be forced to sell their properties regardless of returns. Some portion of rental providers that are already close to mortgage distress may not be able to handle a large upfront investment. REIACT pointed out that, in some cases, unexpected costs like a broken hot water system are enough to push some rental providers into financial distress.

REIACT also pointed out that there are some properties for which it will never make sense to make the upgrades. For some low-cost properties, a large upfront investment to reach a minimum performance standard could be cost-prohibitive. Unless exemptions are available for these types of properties, they will invariably be sold either to owner-occupiers or for demolition and redevelopment.

It was also acknowledged by these organisations that implementation measures which lessen the burden on rental providers have the capacity to negate the effect. A longer phase-in period will give rental providers more time to adjust. Likewise, capacity to pass on costs to tenants or financial support from the government would lessen the sales of rental properties.

E.4.2 Views on rental prices in the private market

The majority of stakeholders recognised the effects on rental prices would be mixed, though generally acknowledged some amount of pass-through is likely. Direct pass through of costs of investment is one channel of potential impacts; however, there was some recognition that secondary effects were possible through the market. There was also acknowledgement that effects could be separated into the short-term and long-term.

In the long-term, representatives of both tenants and rental providers, as well as REIACT, acknowledged that market conditions were such that rental providers would have the market power to pass through up-front costs as increased rents. Tenant's representative bodies acknowledged that there is very little capacity for tenants to react or challenge rent increases, given the market tightness. The exception was Better Renting, which suggested that, for some properties, the market would not bear higher prices.

In the short-term, the effects on rental prices may be muted by changes in the *Residential Tenancies Amendment Act 2019* which limit rental increases for existing tenancies. Rental provider bodies highlighted this as a crucial drag on rental providers' capacity to pass on rent increases. Organisations which represented tenants likewise acknowledged that this could be an issue for many. Views on the capability of rental providers to increase rents for existing tenants under the current laws varied from *difficult* to *impossible*. One solicitor, familiar with the tenancy laws, said:

> *I find the lack of clarity in the laws around rent increases make it inaccessible and often will be difficult to navigate for all parties involved.*

As a result of the friction in raising prices on existing tenants, both rental provider groups and tenant groups acknowledged that rental prices are most likely to fall on new tenants. While rental providers could potentially take the case for excess — above the prescribed amount specified[31] — rental increases to the ACT Civil and Administrative Tribunal, many would wait for a new tenancy to start, or be incentivised to shift to a new tenancy to pass through costs.

Market effects are likely to have secondary effects on rental prices. Any reduction in rental properties as a result of the regulation is likely to result in a greater imbalance between supply and demand, potentially exacerbating high rental prices. Better Renting also pointed out that there is currently a premium on energy efficient properties and on comfortable properties. As a result, it is possible that the rental price premium will be eroded, potentially alleviating the rental prices for those properties already compliant with the minimum standards.

E.4.3 Views on impacts to public and social housing

ACIL Allen spoke to Housing ACT and CHC on the likely impact on the availability or pricing of public and social housing. Both acknowledged that it would be unlikely that the standard would reduce the availability of housing of public or social housing stock. CHC suggested that some smaller social housing providers may struggle to find the financial resources to upgrade their properties to meet the standards.

Both CHC and Housing ACT have specified rental prices for their properties, which are not necessarily based on market conditions and are tied with tenant's incomes. As a result, for the majority of public and social housing, there is unlikely to be rental price increases. For a limited number of properties, tenants pay a market rate, which may be affected.

It was pointed out that tenants of social and public housing express preferences for properties with better energy efficiency and comfort levels. As a result of raising some properties up to a higher standard, it has the potential to increase equity for tenants across the public and social housing stock.

E.5 Views on industry capacity and risk

Industry groups were consulted with as part of the engagement process. The industries that would be primarily affected by the minimum standards are also those that were engaged through direct interviews and workshops. These include:

— insulation installers

— residential electricians

— real estate agents and property managers.

E.5.1 Insulation and electrical industry

Under either of the features-based standards, or under the performance-based standard, much of the work required would be undertaken by the insulation and electrical industries. Representatives from both industries indicated that there was a high degree of capability within the ACT to assist rental providers to make the required changes to their properties.

Electricians are a licensed trade, meaning they are required to undertake training and must meet eligibility requirements. Representatives of the electrical industry commented that heater installations are common and would be routine for many electricians. Given that there is interaction

[31] 110 per cent of the percentage increase in the ABS Consumer Price Index (CPI) for Canberra. See: https://www.acat.act.gov.au/case-types/rental-disputes/rent-increases

between the electricals and insulation, they would also be capable of dealing with installations or upgrades of insulation.

Insulation installation is not a licensed trade. As a result, training is typically on the job. However, one representative of the insulation industry commented that the ACT insulation industry has some of the highest levels of training and capability across Australia and would be able to gear up very quickly to assist rental providers. Where more training is required, the Canberra Institute of Technology (CIT) offers an insulation installation course. The course is also a requirement for the insulation installations as part of ACT Energy Efficiency Improvement Scheme, meaning installers who take the training will be well placed to respond to demand through either the scheme or the minimum standards.

Risks identified

All industry stakeholders commented that there will be few risks to installers. The major risks, especially related to roof insulation installation could all be well managed through experienced installers:

— de-energisation of the roof area by turning off any connection to the mains. Some older properties may not have upgraded to a contemporary residual current device (RCD) or may have dangerous wiring, however, installers check this immediately and advise homeowners to make the upgrade before they enter the roof space
— heat safety
— working at heights
— unsafe installations, such as 'sandwiching' electrical wires or installing insulation on top of downlights.

It was noted that do-it-yourself or untrained installers may not be able to recognise and respond to these risks.

E.5.2 Real estate industry

REIACT commented that property managers may in many cases end up being asked to ensure rental properties meet minimum standards. For example, as a result of the 2019 reforms under the *Residential Tenancies Amendment Act*, property managers have had to educate rental providers and manage the increased regulatory burden. Real estate agents are already facing regulatory fatigue as a result of the 2019 reforms.

It was noted that the introduction of minimum standards would likely cause property managers to assume the role of project managers as properties need to be assessed and upgrades introduced — all of which is much more work than calling a tradesperson to perform basic maintenance on a property.

In one workshop, this assumed responsibility was presented as a potential risk to both property managers as well as rental providers. The legal responsibility to meet the standards will ultimately reside with the rental provider. Where rental providers are acting in good faith on the advice of a property manager, they can still be in breach of the standards and held responsible. Conversely, where property managers provide unwanted advice on meeting standards to rental providers, they risk losing those rental providers who do not want to comply as clients.

E.6 Views on implementation

All stakeholder groups highlighted that implementation considerations were crucial to the outcomes from each of the potential options. Implementation considerations relate to supporting the benefits or ameliorating the costs of the proposed regulations. Implementation considerations (as reflected in Chapter 6) can be broadly grouped by theme, including:

— exemptions
— Class 2 limitations
— performance standard rating validity
— performance standard duplication
— phase-in periods
— education
— complementary measures.

E.6.1 Exemptions

All stakeholder groups recognised that not all properties could be readily upgraded to meet minimum standards. Construction of the underlying property may make upgrades prohibitively difficult or prohibitively expensive. This is especially the case for big increases in performance standards, where upgrades may be prohibitively expensive or difficult as they likely require substantial investment in the profile or shell of the building.

All stakeholder groups acknowledged that there were reasonable exemptions from minimum standards, though there was no consensus of how extensive exemptions should be. Some stakeholders suggested that, for those properties where work was not technically feasible, either an equivalent upgrade should be required, or the property should not be allowed onto the rental market.

E.6.2 Class 2 limitations

Class 2 properties were acknowledged, particularly by industry groups, as being difficult to upgrade under some versions of the proposed minimum standards.

Shared roof space may be difficult, or impossible, for rental providers to upgrade to meet minimum standards. Features, like roof-top gardens or pools, make upgrades of ceiling insulation particularly difficult. Similarly, adding heat-pump units to the outside of Class 2 properties may not be possible for all properties.

Cooperative action is also a limiting factor for rental providers in Class 2 properties. An individual rental provider may find it difficult to organise upgrades through a body corporate, or for individuals to each have to pay for assessments of the same roof space. Improving ceiling insulation in Class 2 properties on a unit-by-unit basis may be more expensive and less effective than building improvements undertaken in a holistic manner.

E.6.3 Rating tool for performance standards

Stakeholders within and external to the ACT Government acknowledged that the multitude of existing energy rating tools was problematic for the implementation of a performance-standard for rental properties. Within the ACT, the majority of new residential properties demonstrate compliance with the energy efficiency standards required by the National Construction Code via a Nationwide House Energy Rating Scheme (NatHERS) rating, while properties advertised for sale require an Energy Efficiency Rating (EER) done through the ACT House Energy Rating Scheme (ACTHERS). Neither of these existing tools are very suitable for the performance standards proposed as they only rate a home’s thermal performance (shell), not the energy performance of appliances.

Existing energy ratings have relatively short validity periods. For example, stakeholder suggested that EERs are only valid for a year. If these ratings are the basis of a standard, they would require rental providers to have costly assessments at a regular interval, dramatically increasing the costs of compliance.

Stakeholders representing both rental providers and tenants pointed out that ACTHERS ratings are no longer best practice and are inappropriate for the proposed minimum standards.

E.6.4 Phase-in periods

Rental provider groups highlighted that longer phase-in periods would allow rental providers more flexibility to respond to any minimum standards. Phase-in periods were acknowledged by all groups as a supporting and necessary aspect of the policy's implementation. Multiple stakeholders acknowledged that whatever phase-in period is used, there will be a 'rush to the door' which risks industry capability and creates avenues for price gouging.

E.6.5 Financial support

As noted in section E.3, cost impacts on rental providers can be a major burden. Both community and private rental providers suggested that financial support would be required in some cases. For some private providers, liquidity constraints will limit their ability to meet the regulations, even with a phase-in period. To some rental providers, the degree of financial support will ultimately determine the net impact of the regulation. Community and public housing providers, who have limited capacity to increase rents will similarly have trouble paying for upgrades.

E.6.6 Education

Members of each of the stakeholder groups identified that behavioural aspects can be as important as upgrades to the property. One stakeholder suggested that the energy efficiency of a rental property was 'two-thirds mechanical, one-third behavioural'. One representative of tenant advocates illustrated the point with tenants who move to properties with a clothes drier, which often causes energy costs to balloon and become unmanageable. There was support across engagements for providing education about how to manage a home's energy use for both tenants and rental providers. Where heaters are provided, in particular, there is a risk that some tenants may face bill shock with sudden additional energy use.

E.6.7 Respect for tenants

One stakeholder identified that the tenants in Canberra's poor performing rental stock are very often the most vulnerable tenant group. Several stakeholders made the point that upgrades and rental property maintenance can sometimes occur unilaterally or in a way that does not respect the needs of tenants, and that upgrades under these regulations must be done in a respectful manner.

E.6.8 Public housing

Groups representing rental providers, through the survey and in direct submissions, highlighted that the minimum standards must be implemented equally for both public and private rental properties. The view was that the ACT Government must lead by example. There was a consistent perception that the public housing stock is of lower quality and should be a higher priority, before asking private rental providers to bear additional regulatory burden.

E.6.9 Draught sealing

Several groups pointed out that draught sealing can in many cases be a cheaper, easier, and more effective upgrade than the proposed minimum standards. Industry groups and community advocate groups noted that often a heater or insulation can be made more effective with draught sealing — or conversely, that there may be limited value of making these types of upgrades without draught sealing.

E.6.10 Sub-tenancies

There is some ambiguity created around the legal responsibility for meeting the standards with sub-tenancies. In some cases, a head-tenant may have a legal responsibility to meet a standard, without the property right to make associated upgrades.

F Survey results

The ACT Government conducted a survey, on behalf of ACIL Allen, as part of the development of this RIS. The survey was conducted using the ACT Government's YourSay platform[32] from 5 May 2021 to 19 May 2021. The survey was published on the YourSay website, on the Directorate's Actsmart social media, and a link to the YourSay survey was also sent to consulted stakeholders to pass through to their constituents and networks.

The purpose of the survey was threefold:

— to understand the existing rental housing stock from the perspective of rental providers and tenants. These insights were incorporated in the problem statement (see Chapter 2)

— to understand rental providers', tenants' and others' (including owner-occupiers) views and preferences between the proposed policy options

— to understand how rental providers and tenants would respond to the proposed minimum standards. These insights informed the impact analysis (see Chapter 5) as well as the implementation considerations (see Chapter 6).

The survey was separated into a rental providers' survey, a tenants' survey and an owner-occupier (and others) survey. Questions regarding sentiment were consistent between surveys, whereas questions regarding the rental stock and tenants and rental provider responses to the reforms were unique to each respondent group. Specific wording varied slightly to aid interpretation.

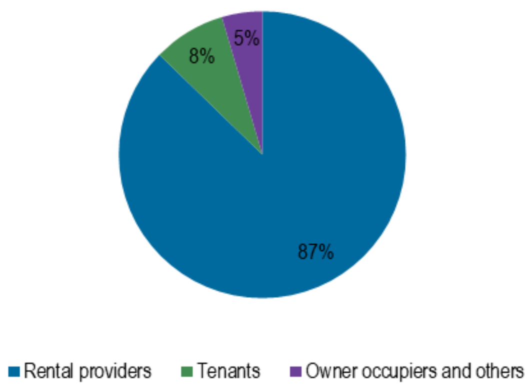
Surveys provide an opportunity to collect information from a larger group of stakeholders. However, there is a limit to the type of information that can be collected through surveys, and an inability to explore issues of interest in more detail. There is a natural trade-off for all surveys between the level of detail asked and survey participation — as survey length dissuades participation. The survey is considered in the context of the stakeholder consultation process and the impact analysis in Chapter 5.

F.1 Survey respondents

The survey had 636 respondents over the two-week period, and the website had over 3,000 views from close to 2,500 visitors. Approximately 85 per cent of responses were from rental providers, with smaller response rates from tenants and owner-occupiers (see Figure F.1). Note that due to the smaller number of respondents, the percentage responses from renters and owner occupiers are a less reliable indicator of overall renter and owner occupier views than those from rental providers.

[32] Available at: https://www.yoursay.act.gov.au/minimum-energy-standards

Figure F.1 Responses by participant group



Source: ACIL Allen

Respondents described properties spread well across Canberra's regions, with tenant and rental providers representing all areas — with the exception of tenants in the Molonglo Valley area. Approximately 43 per cent of rental providers referred to properties in Belconnen and Tuggeranong; while approximately 42 per cent of tenant responses were from the Inner North area. Remaining responses represented properties in Gungahlin, the Inner South, Weston Creek and Woden.

Across respondents, there was approximately equal proportions of those identifying as men and women; as well as significant proportions identifying as non-binary or preferring not to disclose. All age groups are represented in the respondents. Among respondents, tenants were more likely to be younger, while owner-occupiers and rental providers were relatively well evenly spread over age groups.

F.2 Community sentiment

The survey gathered views, sentiments and preferences around energy efficiency for rental properties and the potential options considered. While there were differences between respondent groups, overall there was support for investment in energy efficiency in rental properties and for minimum energy efficiency standards, and agreement that the responsibility for the energy efficiency of rented properties as being on the rental provider (or shared between the rental provider and the tenant). Rental providers were more divided, with just under half supporting compulsory minimum standards for rental properties.

The following sections discuss the results of the survey. These are presented as an equally weighted-response — that is, weighting the responses of each group so they are equal in size — as well as broken down by group.

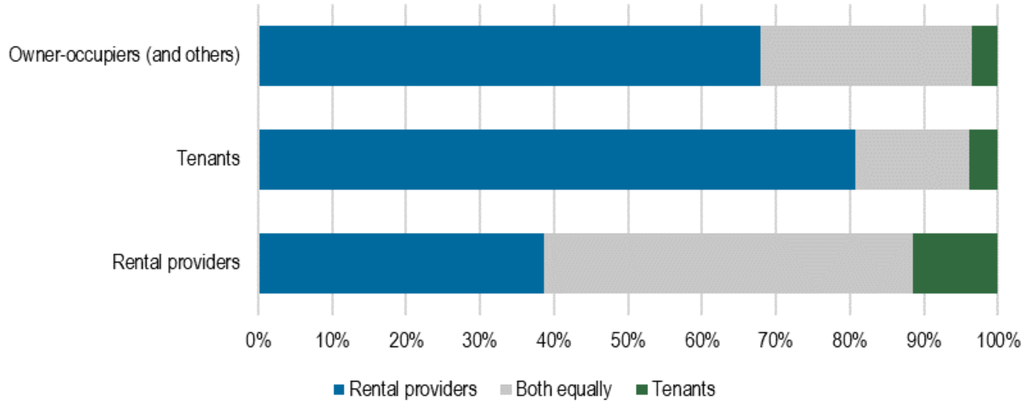
F.2.1 Energy efficiency in rental properties

The survey asked questions regarding sentiments toward energy efficiency investments in rental properties. The survey suggests that the community views the responsibility for energy efficiency of a rental property as being primarily on the rental providers (weighted-response of 62 per cent) or being a shared responsibility of both rental providers and tenants (weighted-response of 31 per cent).[33] Only 6 per cent of weighted-responses were of the view that it was the responsibility of the tenants alone (with this view held almost entirely by rental providers). Among rental providers,

[33] Question: *Who do you think should be most responsible for energy efficiency of rental properties?*

39 per cent viewed it as the sole responsibility of the rental provider, and a further 50 per cent viewed it as a shared responsibility (see Figure F.2).

Figure F.2 Perceived responsibility for energy efficiency of rental properties, by respondent groups

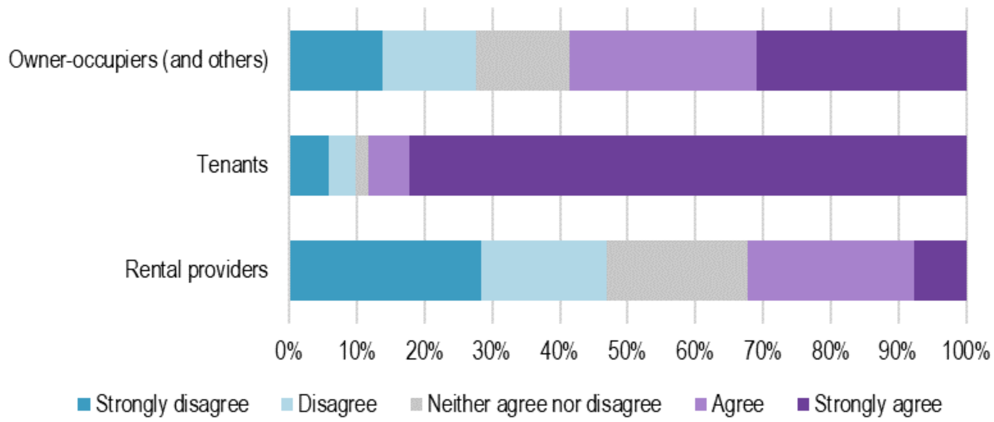


Source: ACIL Allen

Approximately 40 per cent of the equally-weighted[34] response strongly agreed that energy efficiency upgrades are a good investment for rental providers, and a further 19 per cent of the weighted-response agreed with the statement.[35] Only 16 per cent of the weighted-response strongly disagreed with the statement.

However, views diverged significantly between tenants and rental providers. While 82 per cent of tenants strongly agreed that energy efficiency represents a good investment, only 8 per cent of rental providers strongly agreed. Almost one half of rental providers strongly disagreed or disagreed with the statement (see Figure F.3).

Figure F.3 Perceived value of energy efficiency investments in rental properties



Source: ACIL Allen

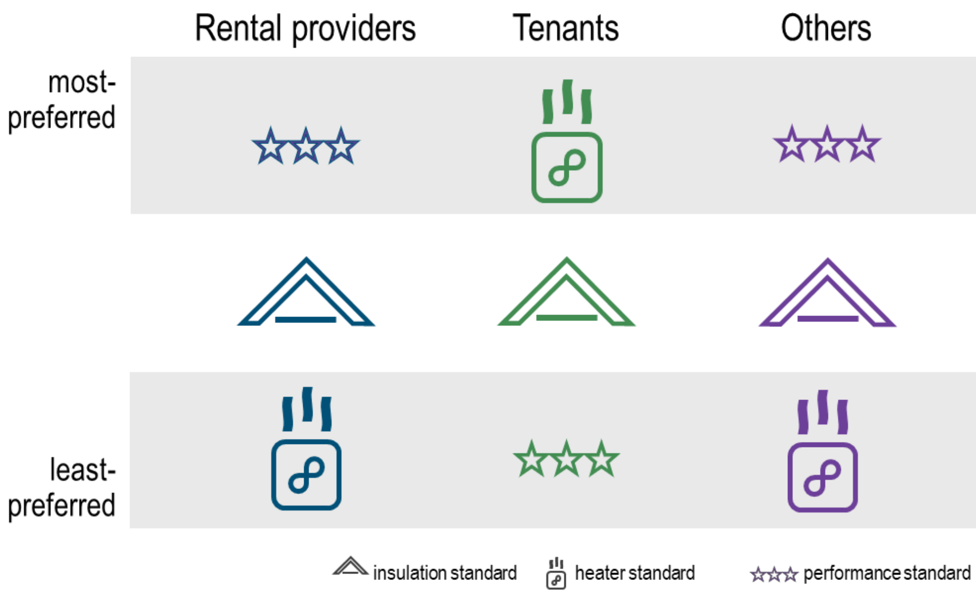
[34] Calculated as one-third of each of the rental providers, tenants, and owner-occupiers. For example, 40% = 1/3 x 8% + 1/3 x 82% + 1/3 x 31% — rental providers, tenants, and owner-occupiers respectively.

[35] Question: *Making energy efficiency upgrades to a rental property represents a good investment for a landlord (lessor).*

F.2.2 Preferences over potential options

Across the survey, there is no consensus on the preferred option for minimum standards in rental properties.[36] Views diverged between tenants, who most preferred a heater-based standard and least preferred a performance-based standard, and rental providers and others who most preferred a performance-based standard and least preferred a heater-based standard. All groups agreed that ceiling insulation was the second most preferred option (see Figure F.4). It is important to note that ranking these options does not necessarily indicate support for any of these options.

Figure F.4 Preferred standard by respondent group



Source: ACIL Allen

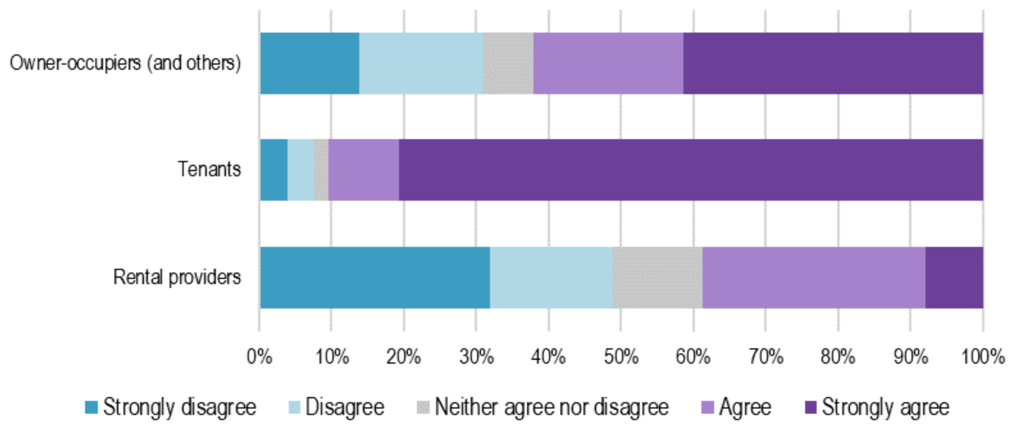
Support for a minimum standard for ceiling insulation for rental properties

Across the survey, 64 per cent of the weighted-response support — either strongly agree or agree — the introduction of a mandatory minimum standards for ceiling insulation, while 29 per cent of the weighted-response did not support a minimum standard for ceiling insulation.[37] Despite not being the first-preference for any respondent group, it had the most positive weighted-response, and the most positive support across the respondent groups. The majority of tenants group (91 per cent) and the owner-occupier group (62 per cent) support the introduction of the standard. The rental provider group was more ambivalent, with slightly more disagreeing with the statement (49 per cent) than agreeing with the statement (39 per cent) (see Figure F.5).

[36] Question: *Out of these three options, which would you most support?*

[37] Question: *Would you support the introduction of a mandatory minimum standard for roof insulation for rental properties in the ACT?*

Figure F.5 Support for the introduction of a roof insulation minimum standard in rental properties

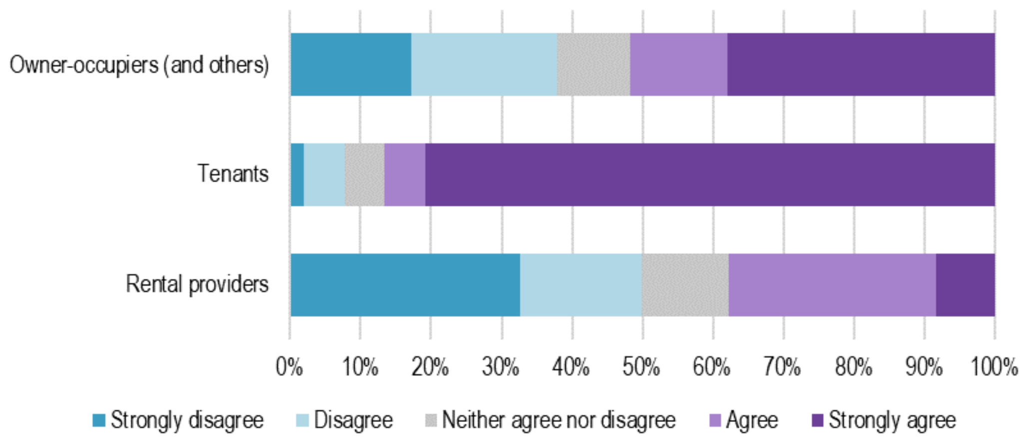


Source: ACIL Allen

Support for a minimum standard for an energy efficient heater for rental properties

Across the survey, 59 per cent of the weighted-response support — either strongly agree or agree — the introduction of a mandatory minimum standard for the installation of an energy efficient heater, while 32 per cent of the weighted-response did not support a minimum standard for the installation of an energy efficient heater.[38] The majority of the tenants group (87 per cent) and the owner-occupier group (52 per cent) support the introduction of the standard. About half of the rental provider group did not support the standard (49.9 per cent) with only 38 per cent supporting the standard (see Figure F.6).

Figure F.6 Support for the introduction of an energy efficient heater minimum standard in rental properties



Source: ACIL Allen

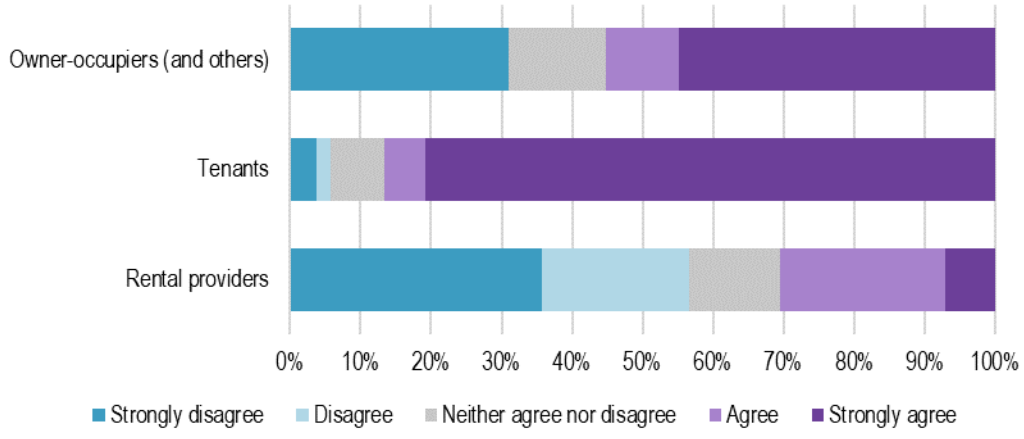
Support for a performance-based minimum standard for rental properties

Across the survey, 57 per cent of the weighted-response support — either strongly agree or agree — the introduction of a performance-based minimum standard, while 31 per cent of the weighted-

[38] Question: *Would you support the introduction of a mandatory minimum standard for the installation of an energy efficient heater in rental properties in the ACT?*

response did not support a minimum performance based standard for rental properties.[39] The majority of the tenant group (87 per cent) and the owner-occupier group (55 per cent) support the introduction of the standard. The majority of the rental provider group did not support a performance-based standard (57 per cent) (see Figure F.7).

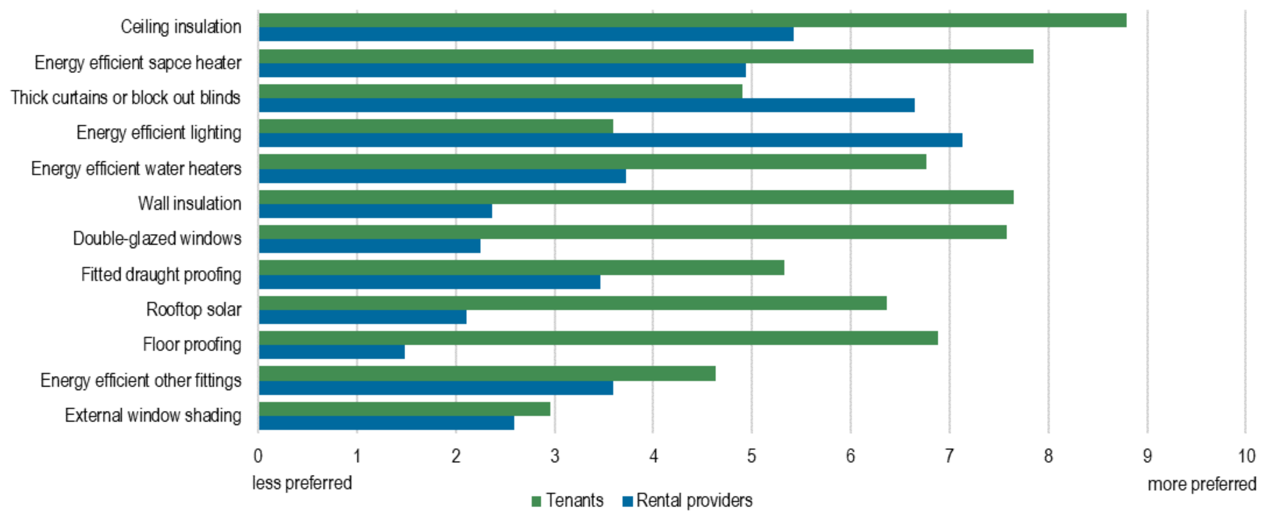
Figure F.7 Support for the introduction of a performance-based minimum standard for rental properties



Source: ACIL Allen

Rental providers and tenants both nominated ceiling insulation and energy efficient space heaters as relatively preferred energy-efficiency upgrades to rental properties.[40] Tenants rated them most preferred, and second most preferred, respectively.[41] Rental providers rated them third and fourth preferred, respectively. Other relatively highly preferred options for tenants include double-glazed windows and wall insulation. Other relatively highly preferred options for rental providers include energy efficient lighting and thick curtains or block out blinds (see Figure F.8)

Figure F.8 Preferred energy efficient improvements in rental properties



Source: ACIL Allen

39 Question: *Would you support the introduction of a mandatory minimum energy efficiency performance standard for rental properties in the ACT?*

40 Question: *What is the most practical option for improving the energy efficiency of your rental property/ies?*

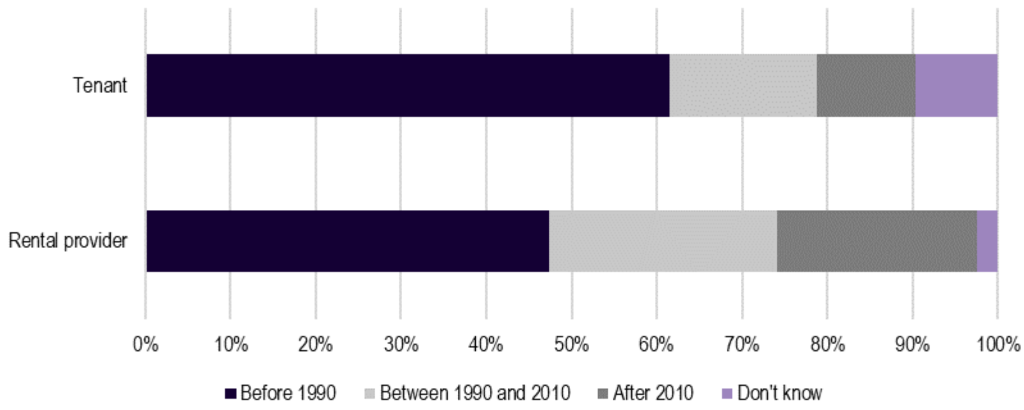
41 Question: *What are your preferred options for improving the energy efficiency of your dwelling?*

F.3 Energy efficiency of rental properties in the ACT

The age of the property is significant for energy efficiency. Gradual changes in building regulations mean that newer properties were built to be more energy efficient. Likewise, energy efficient fittings, such as draught proofing, is more likely to be in good condition in newer properties.[42]

Rental providers and tenants identified that the largest portion of rental properties in the ACT were built before 1990 (see Figure F.9).[43]

Figure F.9 Age of rental properties



Source: ACIL Allen

Significantly, there was more widely diverging views of the energy-efficiency of rental properties between the respondent groups. Though most rental providers rated their property as 5 — the middle of the ten point scale — their average response was higher than the owner-occupier group, which is known to have relatively more energy-efficient properties (see Chapter 2).[44] This suggests that some rental providers may not appreciate how their properties compare to properties as a whole. It is certainly divergent from tenant perceived energy efficiency, for which relatively few answered above 5 (see Figure F.10).[45]

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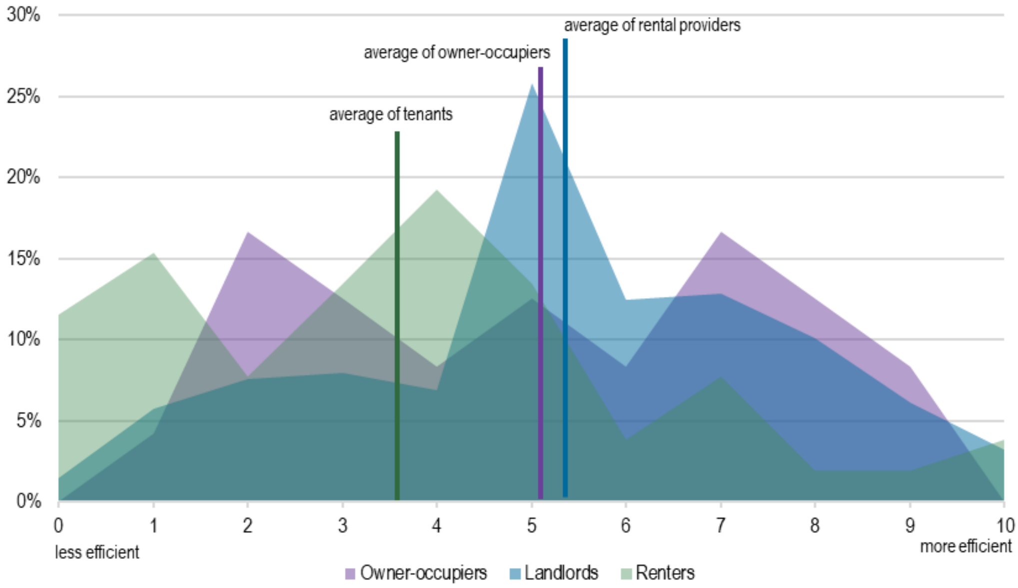
[42] The age of the rental property is a simple and important indicator which requires less judgement. The slight difference between rental provider answers and tenants suggests there may be some skew in the respondents of the survey. Rental providers with relatively better properties, who may have no need to make upgrades and therefore see no value in the standards may have been more motivated to respond to the survey. Likewise, tenants only in poorly performing rental properties may have been more motivated to respond to the survey.

[43] Question: *For your dwelling, was it built approximately:*

[44] Question: *Please provide an estimate of the rating of the energy efficiency of your property.*

[45] Question: *How would you rate the current energy efficiency for your current dwelling (in terms of the home itself and any fixed features/appliances)?*

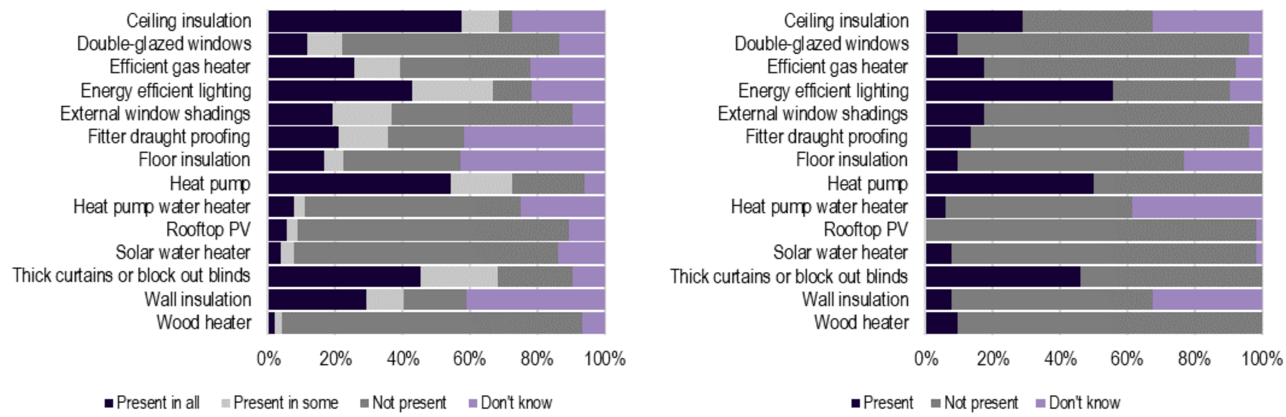
Figure F.10 Perceived quality of housing



Source: ACIL Allen

Reported energy efficiency features of rental properties was relatively similar for both the rental provider and tenant groups.[46] Energy efficient lighting, a heat pump space heater and thick curtains were all commonly reported. Fewer tenants reported ceiling insulation (see Figure F.11).

Figure F.11 Presence of energy efficiency features in rental properties



Properties controlled by rental providers **Tenants rented properties**

Source: ACIL Allen

F.3.1 Thermal control in rental properties

A relatively large portion (73 per cent) of tenants heat their homes using less energy efficient resistance heating — either fixed or portable electric heaters. The second most common form of heating is reverse-cycle split system air conditioners. Only 27 per cent of tenants used gas heating appliances (see Figure F.12).[47]

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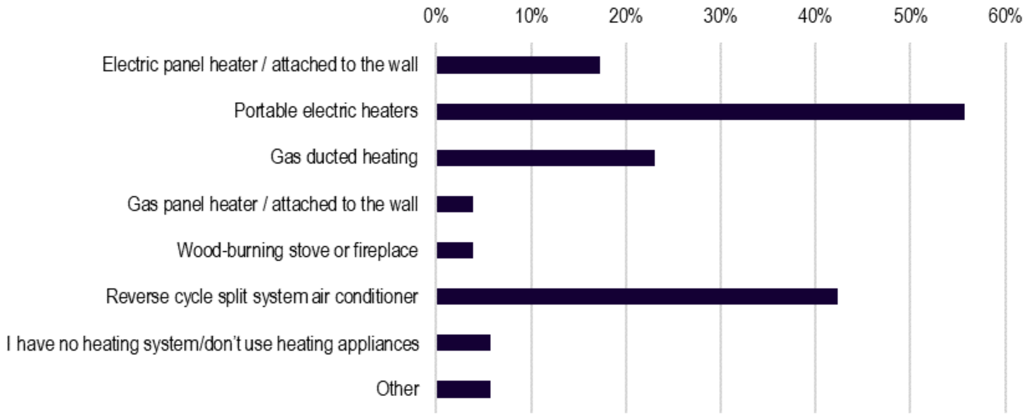
46 Question: *Which of the following are present in your current dwelling?*

47 Question: *How do you heat your home?*

Figure F.12 Method for heating rental properties



Source: ACIL Allen

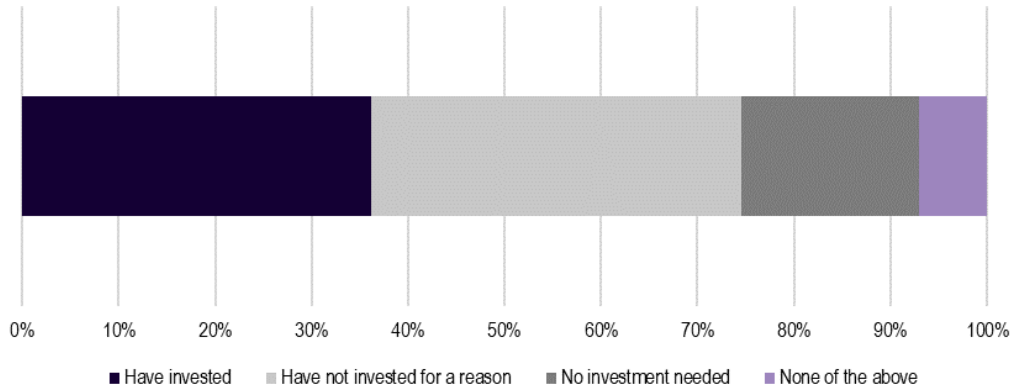
Approximately 60 per cent of tenants use portable electric fans to cool their homes. Approximately the same proportion of tenants use air conditioner units to cool their homes as do heat them (44 per cent).[48]

F.4 Rental provider investments in energy efficiency

Around 36 per cent of rental providers have invested in the energy efficiency of their rental properties. A further 18 per cent do not perceive a need to invest in the energy efficiency of their rental properties (see Figure F.13).

Of the remainder, 38 per cent have not invested in the energy efficiency of their property for a range of reasons. The most common reason was that it was cost prohibitive (28 per cent), followed by a lack of adequate information (6 per cent), the existing tenants have not asked (3 per cent), and because they have plans to demolish or redevelop the rental property (2 per cent).

Figure F.13 Rental provider investments in energy efficiency



Source: ACIL Allen

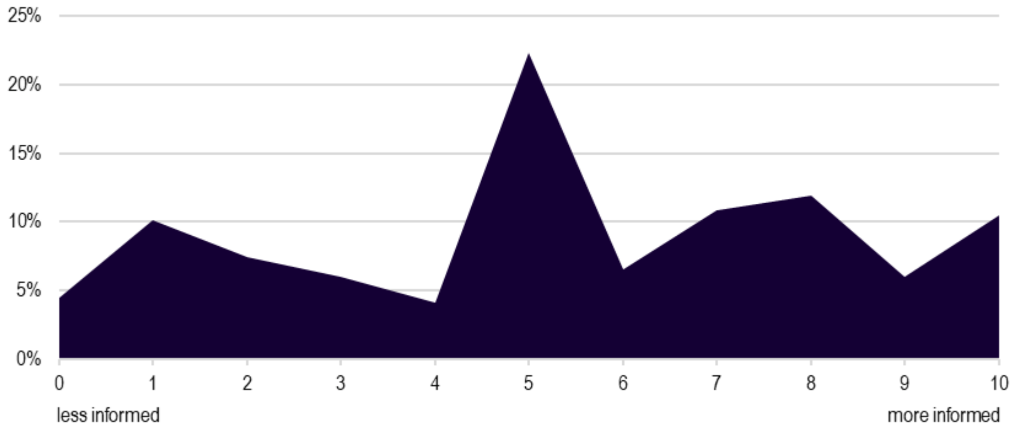
F.4.1 Information available to rental providers

Around 22 per cent of rental providers rated their understanding of ways to improve the energy efficiency of rental properties as half-way (5) on a scale from 0 (not informed at all) to 10

[48] Question: *How do you cool your home?*

(completely informed). Around 46 per cent rated above mid-way, and 32 per cent below mid-way (see Figure F.14). The average rating from rental providers is 5.38.[49]

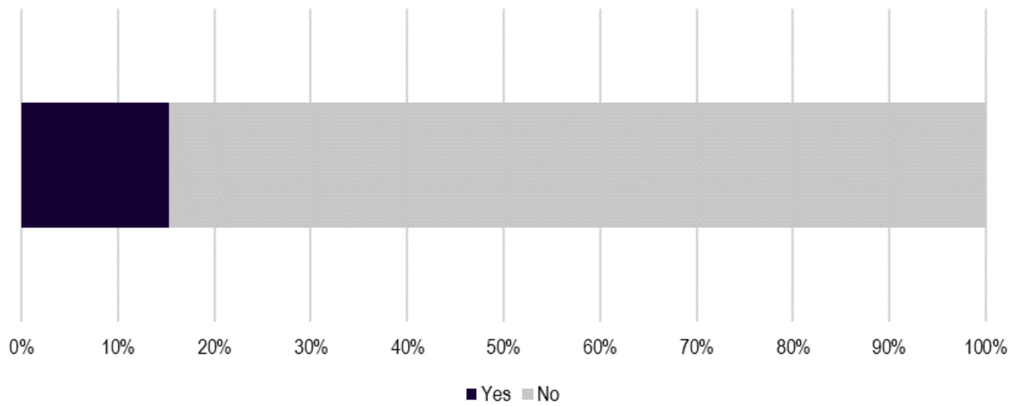
Figure F.14 Rental provider familiarity of energy efficiency improvements



Source: ACIL Allen

Only 15 per cent of rental providers were aware of ACT Government's programs and incentives to improve the energy efficiency of their rental properties (see Figure F.15).[50]

Figure F.15 Rental provider familiarity with energy efficiency incentive programs



Source: ACIL Allen

F.5 Tenant requests for investments in energy efficiency

About half of the tenant who responded have made requests to their rental providers or agents for improvements to the energy efficiency of their homes — 17 per cent have requested once, a further 29 per cent have made more than one request.[51] However, only five per cent of rental providers report having received such a request (see Figure F.16).[52]

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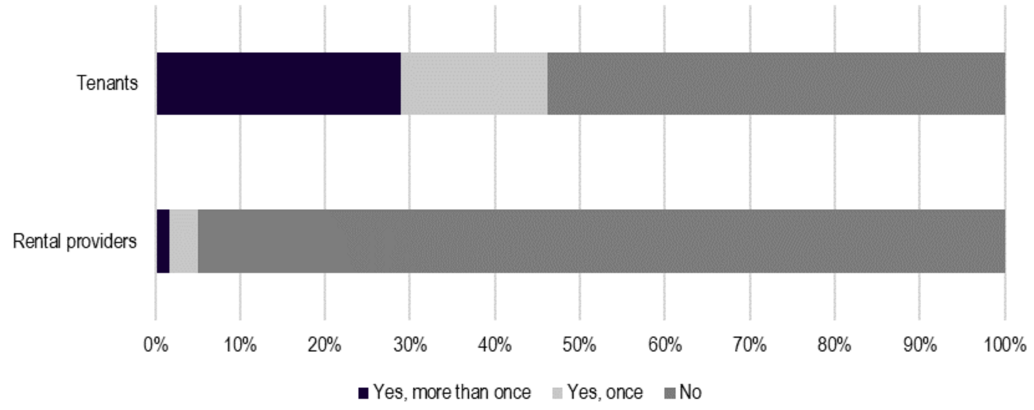
[49] Question: *How informed do you feel about ways to improve the energy efficiency of your rental property/ies?*

[50] Question: *Are you aware of any government incentives to improve the energy efficiency of residential properties?*

[51] Question: *Have you ever asked your lessor (landlord) or real estate agent/property manager about having energy efficiency measures installed (e.g. LED light bulbs, thick curtains or block-out blinds, more efficient heating/cooling system, etc.)?*

[52] Question: *Have you or your property manager ever received queries or complaints from tenants related to energy issues at your property/ies (e.g. bill size or difficulty of heating or cooling the property)?*

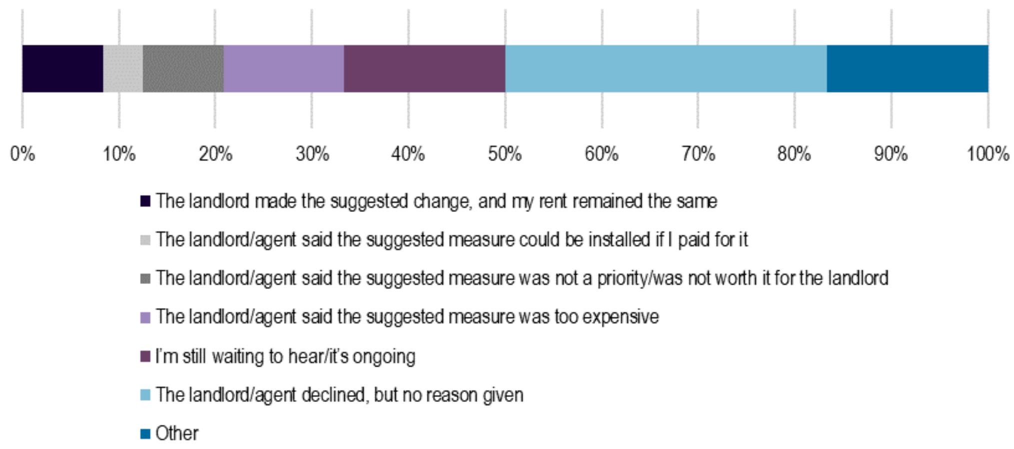
Figure F.16 Tenant requests for energy efficiency improvements



Source: ACIL Allen

Of those tenants who made a request, only 8 per cent had their requested change made with no impact on the rent. 58 per cent of requests were declined for a range of reasons (see Figure F.17). No tenants reported that this was because it was not feasible or too difficult. No tenants reported making requests for change which were then associated with rent increases.[53]

Figure F.17 Rental provider responses to tenant requests



Source: ACIL Allen

F.6 Responses to minimum standards

Rental providers were asked what they might do as a result of the minimum standards.[54]

The impacts of the minimum standards will vary depending on the policy option selected and the implementation, as well as individual conditions for each rental provider. Accordingly, it is reasonably difficult for rental providers to indicate how they will respond to the proposed minimum standards.

Only 16 per cent of rental providers said that nothing would change as a result of the proposed minimum standards. The largest group, almost 60 per cent, suggested that they would increase rents in response. One in five suggested they would sell the rental property, either to other rental

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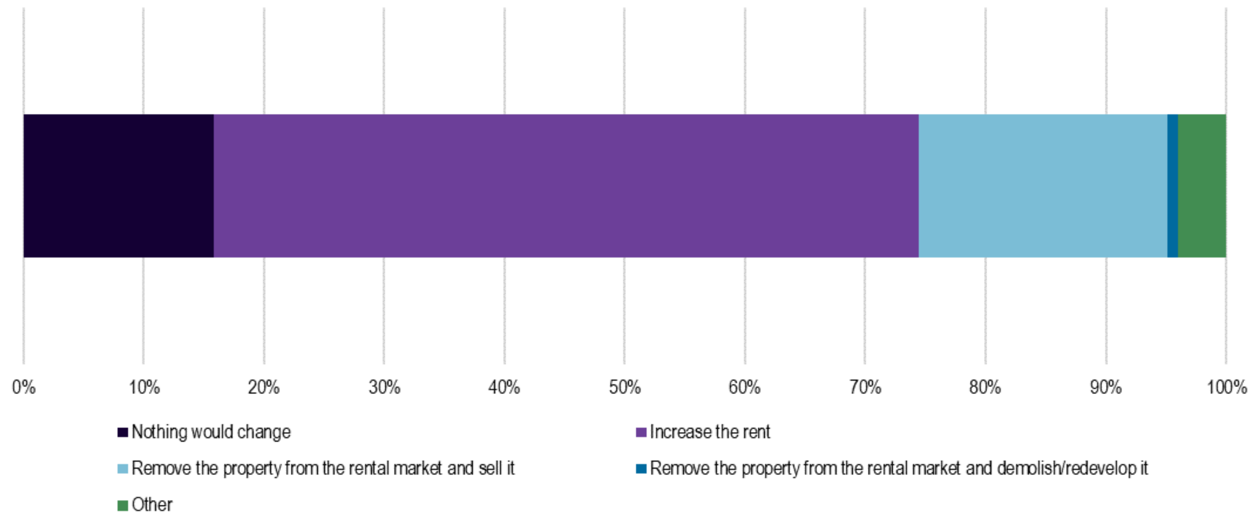
[53] Question: *What was the lessor's (landlord's) response?*

[54] Question: *What, if anything would you do differently in relation to your rental property/ies if a minimum energy efficiency standard required you to invest in energy efficiency measures?*

providers or to owner occupiers. One per cent suggested they would take the opportunity to redevelop the property (see Figure F.18).

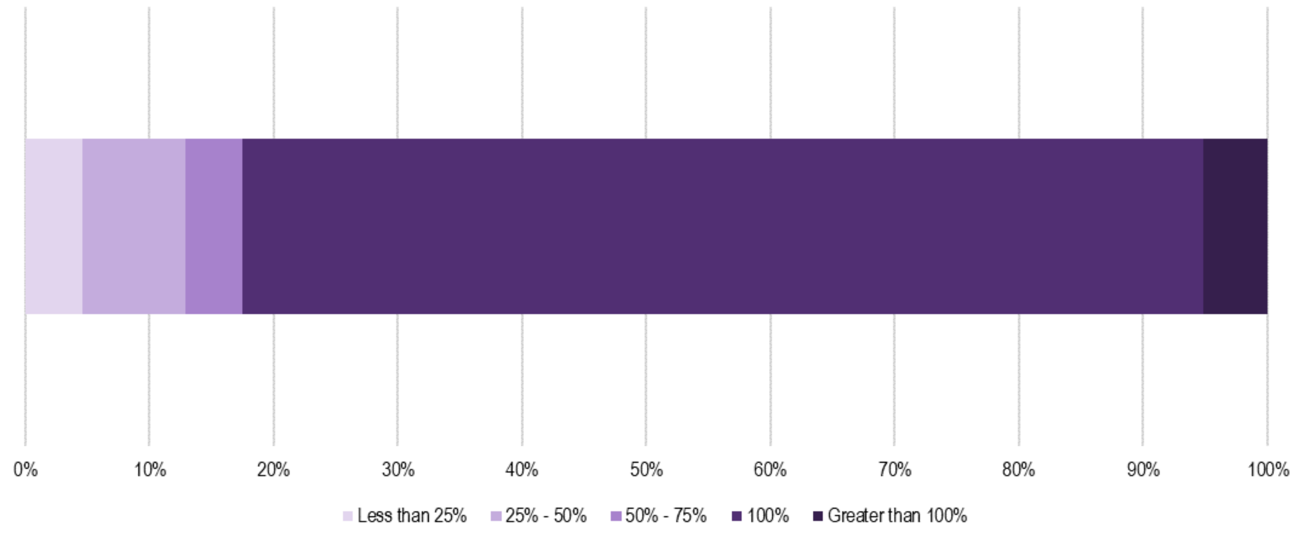
Figure F.18 Rental provider response to minimum standard costs



Source: ACIL Allen

Of those who said they would increase rents, the majority (77 per cent) said they would pass through the additional cost in whole.[55] About 17 per cent would increase rents by less than the additional costs, effectively sharing the costs with tenants. Five per cent said they would increase rents greater than the costs of any required upgrades (see Figure F.19).

Figure F.19 Reported cost pass-through of rental provider costs in the form of increased rents



Source: ACIL Allen

Tenants were also asked how much of the benefit of energy efficiency improvements they were willing to pay for through increased rent.[56] The question was asked relative to a $100 per quarter saving in energy bills and will be less representative at other levels of saving. The most common

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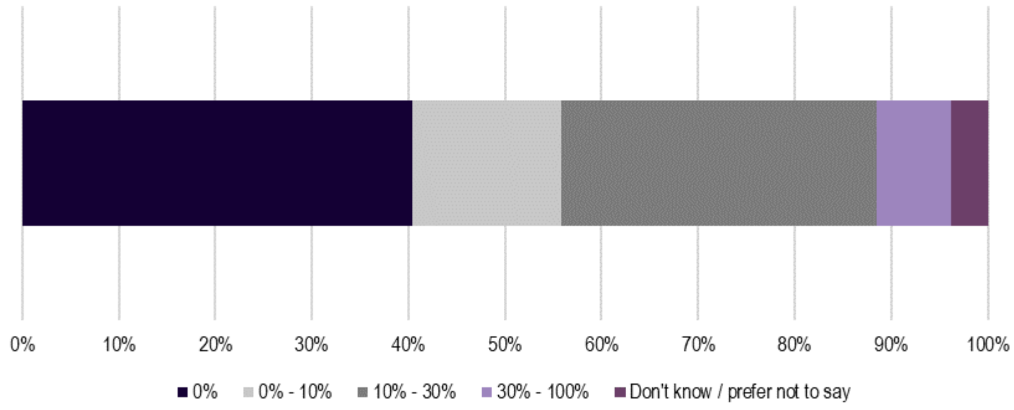
[55] Question: *How much would you consider increasing the rent of your property?*

[56] Question: *If a minimum energy efficiency standard required an investment by your landlord in improvements to your dwelling which saved you approximately $100 per quarter (three months) in energy costs, what additional rent would you be willing to pay?*

response was that they would not be willing to pay any additional rent (40 per cent). Approximately one-third said they would be willing to pay between 10 per cent and 30 per cent of the savings as reduced rent. Only 7.7 per cent said they would be willing to pay between 30 per cent and 100 per cent of the savings in reduced rents (see Figure F.20).

Figure F.20 Tenant willingness-to-pay for energy efficiency improvements



Source: ACIL Allen

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