The Cost of Complacency

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The Cost of Complacency

When a home is more energy-efficient, the occupants benefit from free energy: instead of occupants having to pay to heat their home, the structure of the dwelling itself provides greater thermal comfort. Conversely, people in inefficient homes are being denied this benefit. In this paper we attempt to quantify the dollar value of this benefit to highlight what renters in inefficient homes in NSW are missing out on. We estimate that NSW has over 700,000 rental homes with poor energy efficiency, and that improving the efficiency of these properties would achieve benefits worth $1.199 billion, or $1683 per property. As energy prices continue to rise, the value of this benefit becomes greater. This represents a huge untapped opportunity to address cost of living impacts on vulnerable households.

Introduction

Australian homes tend to have poor energy performance, and rental homes are typically worse still. A home with better energy performance provides its occupants with a healthier and more comfortable home environment with no additional operating costs. Occupants in inefficient homes miss out on these benefits. Instead, they pay more to maintain equivalent thermal comfort. Alternatively, many miss out altogether and have an unhealthy and uncomfortable indoor environment.

This is a critical concern. A home that is too cold in winter or too hot in summer poses a risk to the health of its inhabitants: despite Australia's mild climate, an estimated 6.5% of all deaths are attributable to cold.[1] This is consistent with a pattern of milder-climate countries building less efficient homes that end up having colder indoor temperatures than homes in much colder countries. For comparison, around 3.7% of deaths in Sweden are attributable to cold.

Current trends suggest this may be a growing problem in Australia. The number of renters is increasing, with more people renting long-term. This means more people raising children in rental homes, but also more older Australians in the rental sector. These groups are more vulnerable to health risks, making the need to ensure a healthy indoor environment particularly acute. In addition, energy costs are predicted to rise precipitously over coming years: the latest Budget includes predictions of a 20% increase in late 2022, followed by a 20-30% increase in 2023-2024.[2] These increases will be felt most harshly by those on low-incomes and in inefficient homes, driving a growing number of people to cut back on health-promoting energy services like heating.

A home that is more energy efficient needs less heating in winter and cooling in summer. Effectively, efficiency retrofits provide energy services with an economic value. This paper attempts to quantify the value of these energy services that renters are missing out on due to living in inefficient homes. Our focus is on renters because their homes tend to be less energy efficient. Further, unlike owner-occupiers, people who rent do not have the right to make structural changes (for example, replacing a gas heater with a more efficient RCAC) that can reduce their cost of living. Renters live with unique challenges in this area, warranting particular attention and a tailored policy response.

Methodology

We want to calculate the dollar value of the benefits that renters are missing out on because their properties are inefficient. We model a benchmark of a 3/10 rating on the Nationwide House Energy Rating Scheme, NatHERS. This accounts for the reality that it isn't practical or cost-effective for existing dwellings to be retrofitted to achieve the highest possible energy efficiency rating. Three out of ten represents what could be achieved through modest retrofits to existing dwellings.

How do we then calculate the dollar value of such retrofits? Adapting an approach previously developed by Pitt&Sherry[3], our process involves four steps:

1. We estimate the average NatHERS climate zone of NSW rental homes, allowing us to estimate the energy load per square metre for each energy efficiency rating.
2. We estimate the floor area of NSW rental homes, allowing us to calculate total energy load for an average-sized dwelling at each energy efficiency rating.
3. We estimate the energy efficiency of existing NSW rental homes, allowing us to calculate the number of dwellings at each rating and the corresponding energy load.
4. We then convert from energy to dollars, using current electricity prices, noting that some renters have access to efficient appliances that allow them to heat more cheaply.

Each step is discussed in turn below.

Estimating NatHERS climate zone

Rental homes in NSW are spread across a variety of NatHERS Climate Zones. Each zone requires a different amount of energy to achieve the same thermal result. For example, according to the 2019 NatHERS star band criteria[4], a 0.5 star home in climate zone 25, "Cabramurra", would require 1666 megajoules of energy per metre squared

of floor area. In climate zone 28, "Richmond (NSW)", the requirement is only 555 megajoules.

NatHERS provides data on the correspondence between climate zones and postcodes.[5] Using this, and data from the 2021 Census on the number of renters in each NSW postcode, we can weight the number of renters in each climate zone to come up with a weighted average that represents the average energy needed at each star rating. This turns out to be roughly equivalent to climate zone 15, "Williamtown", or about halfway between climate zones 28 and 56 ("Mascot"). The corresponding energy loads are in the table below. The table also shows the potential energy benefit from retrofitting a property from its current rating to NatHERS 3.

NatHERS rating	0.5	1	1.5	2	2.5	3
Thermal energy load, MJ/m^2.annum	446	363	295	241	198	165
Energy benefit of achieving NatHERS 3, MJ/m^2.annum	281	198	131	76	33	0

Table 1: The thermal energy load at different NatHERS ratings for NSW renters, weighted based upon population density across different climate zones.

Estimating floor areas

To turn NatHERS ratings into energy loads, we need to estimate the floor area of NSW rental homes. This is difficult. The ABS publishes data on the floor areas of current building approvals, but we are concerned with existing dwellings, many of which were approved many decades ago. As a rough estimate, we use the average floor area from 1984-85, the earliest year for which data is available. This value is 149.7m^2.[6] Generally, the trend over time has been for floor areas to increase. As such, the data from 1984-85 is an approximate average capturing that buildings built earlier may have been smaller, and those built later, larger. Although this data is for all dwellings, not necessarily just rentals, Australia's rental stock is not highly differentiated from owner-occupier stock. We can thus extend our calculations to estimated energy loads for an average-sized dwelling.

NatHERS rating	0.5	1	1.5	2	2.5	3
Thermal energy load in MJ/m^2.annum	446	363	295	241	198	165
Energy benefit (MJ/m^2.annum)	281	198	131	76	33	0

Extra energy load for a 149.7m^2 dwelling (MJ/annum)	42136	29630	19543	11437	4990	0

Table 2: Energy load for an average-sized dwelling, for each NatHERS rating from 0.5-3.

Estimating efficiency of existing homes

NSW does not require energy efficiency disclosure when selling or leasing out a property and there is little direct information on the energy performance of existing properties. As a substitute, we use proxy NATHERS rating data from a sample of 15,034 existing dwellings in Victoria, available through the CSIRO Australian Housing Data portal.[7]

Ideally, we would have survey data on the energy performance of existing NSW rentals. However, the CSIRO data is an acceptable substitute, and it is likely conservative. The CSIRO data shows that new Victorian homes tend to be more efficient than new NSW homes; if this pattern has held in the past then the Victorian data is likely to, if anything, overestimate the efficiency of NSW dwellings.

We can thus update our table to show the estimated distribution of rental properties in NSW across the different energy efficiency ratings. Because the Census tells us how many rental homes there are in total, we can then estimate the absolute number at each rating, and thus the total energy load associated with rentals at that rating.

NatHERS rating	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**
Thermal energy load in MJ/m^2.annum	446	363	295	241	198	165
Energy benefit (MJ/m^2.annum)	281	198	131	76	33	0
Extra energy load, 149.7m^2 dwelling (MJ/annum)	42136	29630	19543	11437	4990	0
Est. proportion of rentals at this level	21.9%	21.2%	12.4%	9.7%	9.6%	8.3%
Est. number of rentals ('000)	209	202	118	92	91	79
Total extra energy load (Terajoules)	8792	5988	2312	1054	456	0

Table 3: Table 2, with the distribution of rentals added.

Converting from energy to dollars

We now attempt to put a dollar value on this potential energy gain. To do this, will convert from terajoules to kilowatt-hours, the units in which electricity usage is billed. Energy efficiency improvements provide energy services at no costs, either reducing the need for heating in winter or the need for cooling in summer. With this calculation, we value energy efficiency by quantifying how much it would cost to use electric heating to achieve the same thermal result. This analysis is neutral with regard to heating vs cooling loads, relying on an assumption that cooling is achieved with the same efficiency as heating. We discuss this assumption in the next section. We use the current NSW market price for one kilowatt-hour of electricity, 28.54c.[8]

Many renters heat using relatively inefficient heaters that consume one unit of electricity to produce one unit of heat energy. However, some renters in NSW have access to efficient reverse-cycle AC which can use one unit of electricity to provide multiple units of heat energy. This means the heat is worth less to these households, because they can obtain it more cheaply. The latest Energy Consumer Behaviour Survey suggests that 28% of rental households in NSW have RCAC.[9] This survey has a small sample of NSW renters and the true figure could be higher or lower than this. However, we think it is likely an overestimate because RCAC is likely to be concentrated in newer, more efficient households. The inefficient properties we are concerned with are ironically less likely to have good appliances. For our calculations, we will assume that 28% of the energy could be provided using RCAC with a Coefficient of Performance of 3. This results in an average CoP across all rentals of approximately 1.25.

Results and discussion

To recapitulate: the 2021 Census showed 952,329 rental properties in NSW. Based on the pattern in Victoria, we estimate the distribution of these properties across different NatHERS ratings. For example, 209,000 of these properties would achieve a NatHERS score of 0-0.5. These properties are spread across multiple climate zones and are multiple different sizes. Taking the average climate zone and the average property size, each 0.5-star dwelling needs to gain (or lose) an extra 42,136 megajoules of energy each year to achieve the same thermal comfort as in an equivalent dwelling with a NatHERS score of 3. This is equivalent to 11,704 kWh, or running two 2.4 kW panel heaters non-stop from the start of June through August.

NatHERS rating	0.5	1	1.5	2	2.5	3

Thermal energy load in MJ/m^2.annum	446	363	295	241	198	165
Energy benefit (MJ/m^2.annum)	281	198	131	76	33	0
Extra energy load, 149.7m^2 dwelling (MJ/annum)	42136	29630	19543	11437	4990	0
Est. proportion of rentals at this level	21.9%	21.2%	12.4%	9.7%	9.6%	8.3%
Est. number of rentals ('000)	209	202	118	92	91	79
Total extra energy load (TJ/annum)	8792	5988	2312	1054	456	0
Extra energy load (GWh/year)	2442	1663	642	293	127	0
Value per property ($/year)	2717	1911	1260	737	322	0
Total value per year (million dollars)	567	386	149	68	29	0

Table 4: For each energy efficiency rating, the value per property of improving its energy efficiency to 3, as well as the aggregate value for all rental properties in NSW.

If an equivalent amount of energy were obtained using a blend of plug-in heaters and RCAC, it would cost $2717 annually per 0.5-star dwelling. The total value across all inefficient rental homes is $1.199 billion per year. This is the value that could be created by retrofitting rentals with basic measures like ceiling insulation, window treatments, and draught-sealing.

Note also that energy costs are projected to increase over the coming 12 months. The latest Budget included forecasts of an upcoming 30% increase in electricity prices.[2] If this forecast materialises it will dramatically increase the potential value of energy efficiency retrofits, to upwards of $1.5 billion.

This amount is not the same as potential bill savings. Many households, particularly low-income renters in inefficient homes, reduce energy costs by rationing heating in winter. They thus have less potential to save money by reducing energy consumption. Instead, the benefit to these households is through free warmth, improved comfort, and the better health that flows from this. The dollar figure represents what it would

cost to obtain the same energy by running heating appliances compared with the energy efficiency retrofits.

We arrived at this estimate through various assumptions. Better data on house sizes and the energy efficiency of existing stock would assist with arriving at an estimate that has less uncertainty. In general, the challenges we encountered highlight the need for jurisdictions to better know their own housing stock and make this data publicly available.

As noted above, we are treating heating and cooling as equivalent. One problem with this is that heating and cooling appliances have different efficiencies. A basic electric heater has a CoP of 1, using one unit of electricity to produce one unit of heat. This makes analysis simple. But there are no equivalent cooling appliances. Many renters don't have any cooling appliances or use pedestal fans that improve subjective comfort without cooling the environment in the fashion of an air conditioner. However, this doesn't undermine our conclusion. We are estimating the value of the energy services provided by an efficient home — it seems fair to value heating at the market price used to provide thermal energy, and to value cooling to at least the same extent. A finer-grained analysis might look just at heating loads, or separate out heating and cooling loads and apply different efficiencies to each load. We also note that we are assuming electric heating. Again, a finer-grained analysis might separate out gas heating. We suspect this would increase the potential economic benefit, given the reduced efficiency of gas appliances and the increasing cost of fossil gas.

Conclusion

A confluence of various unfortunate events means that energy costs for renters are more topical now than ever. More people are renting, rents are higher than ever, and so are energy costs. Governments across Australia are looking at ways to blunt the edge of electricity price increases, with the Commonwealth even considering price caps on gas.

Our analysis reveals another way for governments to assist households. Driving energy efficiency retrofits of rental housing will bring about energy benefits worth a total of $1.199 billion, and $2717 per household that is currently at or below 0.5 stars energy efficiency. Such retrofits could be achieved through the introduction of minimum energy efficiency standards for rental properties, which could mandate weather-proofing features such as ceiling insulation, draught-sealing, and window treatments. Such a standard would reduce living costs, while also contributing to better household wellbeing, improved public health, and lower climate pollution.

Australia is a mild-climate country that has generally taken a ‘she’ll be right’ approach to the energy performance of our housing stock. The downside of this is there are now millions of people renting in NSW whose homes offer little protection from the elements and saddle them with avoidably high energy costs. The upside of this is that there’s still a lot of low-hanging fruit left to pick. There’s ample opportunity for government regulation to drive the uptake of simple efficiency measures that can make a huge positive difference for the growing number of people renting their homes.

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