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Energy saving rental makeover

Sebastian Crangle walks us through improving the energy efficiency of a rental property, guided by Scorecard.

People who rent their home deserve a comfortable, energy-efficient place to live. All too often, landlords do little to improve the energy efficiency of their investments, simply because they don't have to live there, or pay the energy bills! It's a phenomenon known as "split incentive"—i.e., perceiving that only the tenant will reap the benefits of investing in energy efficiency. In this case study, I'll give several examples of a broad range of actions a homeowner or tenant can take, from simple low-cost measures, through to actions with a higher capital outlay yet bigger rewards. I'll also illustrate the relative impact of those measures in terms of some key metrics of energy efficiency.

For this case study I'm using my own "granny flat", part of our house in northern NSW that we rent out. I work as an energy consultant and Residential Efficiency Scorecard (Scorecard) assessor so this was a good opportunity for me to "walk the talk", and to utilise the Residential Efficiency Scorecard assessment tool[i] to objectively model the progressive positive impact of improvements. With the results from a series of Scorecard "variation" assessments, I'll illustrate the impacts of these improvements in terms of annual energy consumption, carbon emissions and energy costs, as well as "winter fabric loss" measure of thermal performance. These comparative measures are derived from the data inputs of Scorecard assessments, including details of the dwelling's building shell and the efficiency of fixed appliances like lighting, hot water systems and heating/cooling.

What's the motivation?

Landlords have several good motivations to invest their time and/or money in improving the efficiency of their rental properties:

- To better attract and retain tenants: by providing a property with features that make it more comfortable (easier to

The original curtains (above) were thin and sheer and did very little to retain heat. The new curtains (right) are much thicker, with a thermal lining.

> *A property with a high energy efficiency rating consistently attracts a higher return, up to 9.4% for a 7-star house.*

A retrofitted Methven Kiri Satinjet shower head, from Pure Electric.

maintain comfortable temperatures) and is cheaper to run (uses less energy)
- To improve the value of the property for resale (for the same reasons as above). There have been studies to demonstrate that a property with a high energy efficiency rating consistently attracts a higher return, up to 9.4% for a 7-star house (versus 3 stars[ii])
- For compassionate reasons: rental tenants are more likely to live in properties that are inherently inefficient and cost more money to heat and cool[iii]. A home with poor thermal efficiency can be uncomfortable and even unhealthy to live in, and yet the tenant has limited powers to improve the home themselves
- Environmental: your carbon footprint as a landlord extends to investment properties because you have the capacity to make permanent improvements to those properties that reduce their inherent energy demand, and hence carbon emissions—regardless of who lives there.

'Granny-flat' case study

I live in northern NSW where housing affordability is at a crisis level and it seems every second house has a granny flat that is rented out to those who can't afford to buy or rent a whole property for themselves. In my case, I rent out the ground floor of our split-level house, a 60 m² self-contained flat. We're renting this space to a retired gentleman, living on the pension.

Nevertheless, the examples in this case study could relate to any rental apartment or even a full house, whether or not it's rented.

In the past few years I've worked on improving the energy efficiency of the whole house, and have included the granny flat in these retrofits despite the split incentives of doing so. Before I started, a Scorecard assessment rated the flat alone at 3.8 stars (out of a possible 10). It was riddled with features that caused it to have poor thermal comfort and high energy demands: halogen lights, draughts, no insulation, thin curtains and standard off-peak hot water, to name a few.

The low-cost, low hanging fruit

Here's a brief description of improvements I've made to the rental which don't cost a lot of money, and aren't difficult to implement. I won't go into a lot of detail on how they were done as there's plenty of other articles in

Left: Draught seals on a sliding window—a foam product from Raven and some self-adjusting perimeter seal, known as "EMV". Right: insulating a window with bubblewrap, AKA bubbleglazing.

past *Renew* magazines. If you don't have the time or know-how to do them yourself, there would be professionals available to do them for you, especially if you live in a capital city.

In summary, the low-cost actions I took were:

1. Draught proofing
2. Heavy curtains
3. Window insulation
4. Showerhead upgrade
5. Self-sealing exhaust fans

Let's look at these improvements individually to see what was done and how simple they really are.

- Draught proofing:

"Some houses are so draughty that the effect is like having a window open all the time, making it difficult to maintain a comfortable temperature and increasing heating and cooling bills."[iv]

For the granny flat I focussed on weather stripping all the doors and windows, using a variety of purpose-made self-adhesive draught-stopping products. Some of these are available for purchase in hardware stores, or from specialised online stores such as ecoMaster or Tight House.

- Thick Curtains

Curtains can make a big difference when it comes to keeping in warmth, reducing the effect of windows to conduct cold into your home. In this case I replaced thin, sheer curtains with thick, heavy drapes with a thermal lining—on glass sliding doors and some wide windows.

- Window insulation

A well-known hack for renters wanting to improve the thermal performance of their home is simply applying bubble wrap to a window. Of course, it's ideal if it isn't a window you want to look out of, but at least it still lets in light, and provides some visibility. It's certainly a cheap fix, and quite effective, especially given that up to 40% of a home's heating energy can be lost through windows[v]

Bubble wrapping windows may not be an action that's appropriate for a landlord to suggest to a tenant, rather something the tenant could do themselves, if appropriate. If however you're a landlord who's willing to spend more to improve their investment, secondary double glazing is a good option, especially in colder climates.

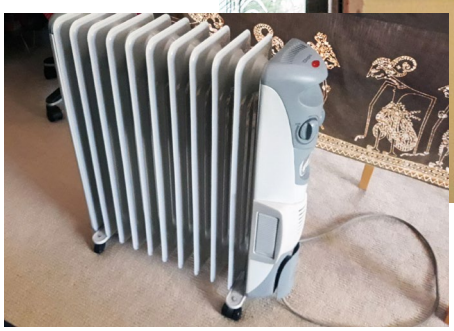
There are many tutorials on online for how to do bubble wrap insulation, see references at the end of this article.[vi]

- Shower head upgrade

Changing a shower head to one with a lower flow rate not only saves water, it also saves energy—because less hot water is needed. In this granny flat I replaced a standard shower head (using 12 litres per minute) to a 3-star head that uses 7 litres per minute (a Methven Kiri Satinjet). That's a 42% saving in water and energy for the same length shower, at a cost of around $130. Good quality low-flow shower heads still provide a great shower experience, dispelling the myth that all low-flow showers are awful.

- Self-sealing exhaust fans

There were two exhaust fans in the granny flat, one in the bathroom and another in the kitchen. Both were unsealed, which allows air to transfer outside through convection, causing draughts and a break in the thermal barrier. The solution is to either retrofit a self-sealing cover over the top of the existing fan



Left: The redundant radiant heater.
Above: The new reverse-cycle air conditioner, which is up to five times more efficient than the radiant heater. It was a bit of a tight fit between the windows!

Solar PV is just one of the many additions to the building, but one that can make a big difference in mains-grid energy consumption.

(available from online stores like ecoMaster[vii]), or to replace the fan with a model that automatically seals when it's turned off. The result will be a considerable improvement in heat loss/gain from air leakage.

Outcomes of the low-cost actions

The before and after results of modelling from the Residential Efficiency Scorecard tool provide us with objective measures of the outcomes of these low cost, low effort actions. So, what has changed in the amount of energy required to keep the apartment comfortable in all seasons (warm in winter, cool in summer)? The short answer is that when combined, these low-cost improvements would make the unit around 18% more efficient, with a saving of approximately 2240 MJ of energy and 576 kg (more than half a tonne) of CO_2 each and every year thereafter. Moreover, they would save almost $100 in energy costs per year (and rising…) for not a lot of outlay. See Table 1 for more detail on these calculations. The Scorecard star rating improved from 3.8 to 4.4 stars.

Higher-impact improvements

There are other improvements I've made to the energy efficiency of the granny flat over the last few years which cost more but had

		Scorecard star rating	Energy per year (MJ)	Energy costs per year	Winter fabric loss (MJ)	Carbon emissions per year	Energy savings (MJ/year)	Energy cost savings ($/year)	Carbon savings (kg/year)	% Energy and carbon savings	
1	Original flat—before improvements (2018)	3.8	14,405	706	6058	3702					
2	Impact of low-cost DIY actions: efficient shower head, thick curtains, draught proofing, self-sealing exhaust fans	4.4	12,165	612	5264	3126	2240	94	576	18%	% improvement after low-cost actions taken
3	Impact of high impact/cost actions: RCAC, heat pump hot water, LED lights, wall insulation retrofit	6.9	3751	270	3244	963	10,654	436	2739	77%	The combined effect diminishes the % impact of the low-cost actions due to diminishing returns after large-impact actions taken
4	Impact of both high and low cost actions (the apartment as it is now)	7.2	3354	241	2399	862	11,051	465	2840	80%	

Table 1: Scorecard modelling showing improvements to energy savings (and carbon emissions). The table shows more details on how the flat would have rated at different stages in the improvements made to it, using the modelling from Scorecard. To get these figures I did three retrospective assessments of the apartment in the Scorecard tool, in these stages:

1. The original apartment, prior to all improvements (c. 2018).
2. With just the low cost/effort improvements (shower, draught stopping, curtains).
3. With all high impact improvements (insulation, heat pump hot water, AC, LED lights, but excluding solar).
4. With both low and high-cost improvements.

Wall insulation was added when the walls were reclad.

a bigger impact on energy costs and carbon emissions. These were:

- Efficient reverse-cycle air conditioner
- Wall insulation retrofit
- Heat pump hot water system
- LED lighting, replacing halogen
- Solar PV

- Efficient reverse cycle air conditioner

Before I installed air conditioning in the granny flat my tenants had been using a combination of fan heaters and panel (oil) heaters, all of which are relatively inefficient (compared to air conditioning) and costly to run due to high energy consumption. The up-front cost was $1600 for an efficient 3 kW unit. I calculated that the energy it would save would equate to about $1.20 per day, on days when the old heaters would have been used. At this rate it isn't necessarily an action that would "pay for itself" as people expect solar PV to do, and the tenant would receive the savings. Yet I did it anyway, for the motivations given at the beginning. And, of course, it can be used for cooling in the summer months as well.

- Wall insulation retrofit

A few years back we re-clad the southern and eastern walls of the house (see photo), due to rotting weatherboards. In the process I made sure to have insulation added to the wall cavity. As the house was built in 1984 it otherwise had no insulation. That was an opportunistic efficiency upgrade but it is possible to have insulation pumped into wall cavities through temporary holes in the cladding—without having to remove or replace it.

- Heat pump hot water system

Last year we replaced our standard electric hot water system (resistive storage) with a 'heat pump' system (Hydrotherm). As many readers know well, this technology pumps heat from the outside air into the water, using as little as a quarter of the energy than a standard system. We also put it on a timer to heat from our solar PV during peak production each day.

This was another improvement that benefitted the whole house, ourselves and our tenant included. However it wouldn't

The latest Scorecard report and star rating for the flat as it now is, with all improvements made (excluding solar).

> *When we started the granny flat alone had over 20 halogen downlights, each using around 60 watts of power. With LED replacements that use 10 watts, the energy use for lighting is decreased by over 80%.*

be out of the question to replace a hot water system on an investment property, especially if it's at the end of its life. The question is more whether you are willing to spend considerably more for a heat pump (they can cost from $2500 to $5000, plus installation), to reap the benefits of much lower energy consumption to heat the same amount of water.

- LED downlights replacing halogens

When we started, the granny flat alone had over 20 halogen downlights, each using around 60 watts of power. With LED replacements that use 10 watts, the energy use for lighting is decreased by over 80%. Replacing halogen downlights can be expensive, but the energy savings pay back the cost in a short time, likely one or two years. However, there are some very low-cost options around now—LED bulbs only cost a few dollars each, and many LED fittings are under $20. The cost only increases if the fittings are hard-wired and an electrician is needed, but if your existing halogens are plugged into power sockets in the ceiling, you can change the fittings yourself.

If you live in NSW you may also be eligible for the government rebate: bit.ly/NSW-lighting-upgrade

- Solar PV

Over the last few years we've added 5.4 kW of solar to the house, with our tenant receiving a share in the financial benefits of our subsidised energy bills.

Outcomes of high-cost actions

What impact did these "big ticket" energy improvements make to our rented granny flat? The Scorecard modelling indicated a whopping 77% improvement in energy consumption and carbon emissions, and that's without including the solar PV (which would knock them out of the park).

From the updated Scorecard certificate, the flat now rates at 6.9 stars (out of 10). This rating doesn't include the low-cost actions described above, only the big-ticket items. When you combine all the measures together (low and high cost, as the flat is currently), the outcome was a rating of 7.2 stars, with an 80% improvement in energy consumption and carbon emissions.

To put that rating in context, the average home is 3 stars, and the highest a home can score without solar PV is 8 stars. The Scorecard star rating is a measure of the cost to run the fixed appliances in a home whilst keeping it at healthy, comfortable temperatures.

A happy tenant

So what does Jon, our tenant, think of the changes to the flat?

"I rent the downstairs flat so my dwelling is on the slab. In winter in particular, no sunshine makes it into my flat due to the layout of the upper levels; there are lots of windows so there is sufficient light but the sun can't enter to provide any warmth. I particularly noticed how cold the interior walls would be to the touch in winter here and the difficulty in heating the space.

When the external cladding was replaced and quality insulation put in the wall cavity, the effect was remarkable. Not only was it warmer inside but you could put your hand on the internal gyprock and feel how the surface was no longer freezing as it had been. This meant heating in the flat was more effective. There was also a noticeable decrease in draughts as the old timber cladding had allowed gaps to develop," says Jon.

"But the most amazing change was when the aircon unit was installed here and suddenly I had a way to provide instant warmth. This has been a truly remarkable change as now on rising on a winter's morning, when it can be under 15 °C in this flat, suddenly within 15 minutes the aircon has completely warmed the whole space. I know from Seb ... this has substantially reduced my energy usage which is good for my wallet and good for the environment," Jon continues.

Conclusion

I hope this brief case study will provide some motivation (and ideas) to rental property owners in a position to improve the energy efficiency of their properties, either by investing in higher cost/return capital improvements, and/or a range of low cost, low effort initiatives. And for people currently renting, I hope you learnt some ideas for improvements you can make yourself, or request of your landlord.

There are many resources available for more information on this topic of improving the energy efficiency of rental properties. If you are interested in getting a Scorecard assessment, see homescorecard.gov.au for an assessor in your area. Also see the references below for a few more resources that have helped me on my own energy efficiency journey.

References:

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(v) Windows: yourhome.gov.au/passive-design/glazing

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