

Sanctuary

MODERN GREEN HOMES

ISSUE
54

RENOVATION &
RETROFIT SPECIAL

Retrofitting for energy efficiency; a strawbale Passive House; design for bushfire & climate resilience; keeping backyard chickens

Old house
» green house

Creative
renovations
and inspired
additions

PUBLISHED BY **renew.**
AUTUMN 2021 • AU/NZ \$12.95
SANCTUARY.RENEW.ORG.AU

ISSN 1833-1416



9 771833 141000

WIN

\$5000 worth of Victron Energy premium solar equipment sponsored by Commodore Australia

Offer open to Australian residents. Details page 9

CREATING COSY:

Retrofitting for energy efficiency and thermal comfort

WORDS Jenny Edwards



↑

Window dressings – good quality curtains, or thermal blinds like these ones – can make a big difference to the thermal performance of your home, and are worth considering as part of an energy efficiency retrofit. Image: Ben Wrigley

Before you push over your leaky old home and build new, consider the potential of what you already have: with the right advice, many existing houses can be judiciously upgraded for a fraction of the cost of a new build. Building scientist Jenny Edwards of Light House Architecture & Science explains where to start and what's achievable.

There are many ways to improve your home, with a wide range of benefits and a wider variety of costs. You can renovate, you can extend, give it a lick of paint, replace the floors, or get a new kitchen. You can also do a thermal retrofit, which focuses on energy efficiency and thermal comfort – a sensible response to increasingly hot summers, rising energy prices and many people's experience of spending a lot more time at home during pandemic lockdowns.

Because there's often not much to see, this kind of upgrade doesn't have the excitement of tangible improvements like a fancy benchtop, tiles, or freshly painted walls. Those things can all have benefits, but they don't improve the temperature stability, energy efficiency or healthiness of your home.

Many people overlook the possibility of an energy efficiency retrofit because they think their house can't be salvaged, or because they just don't understand how easy it is to make big gains. Too often, perfectly good buildings that could function brilliantly with a small investment are demolished and replaced with a new building that barely meets minimum energy efficiency requirements.

It's worth considering making thermal comfort and energy efficiency the main focus of your renovation. Alternatively, if you are going to do other home improvements, then spend a bit of extra time and money improving the energy efficiency at the same time. That way, your home will not just look better but feel better too. It can also reduce your running costs, which will help pay for your other improvements!

START WITH GOOD ADVICE

Every house is different, so it's a good idea to get expert, tailored advice to help you prioritise decisions in terms of cost-effectiveness. Just as you seek objective medical advice before undergoing medical procedures, you should seek some objective building science advice before retrofitting your home. A small investment in good advice will give you the confidence to proceed and get you better 'bang for your buck'.

Your local council may well offer free or subsidised retrofit advisory services, or you can engage an energy efficiency assessor. To find a NatHERS Accredited Assessor, contact one of the three accrediting organisations (Design Matters, ABSA and HERA), or if you are in the ACT you can find a list of assessors licensed to assess existing homes on the Access Canberra website (you need a Class A assessor).

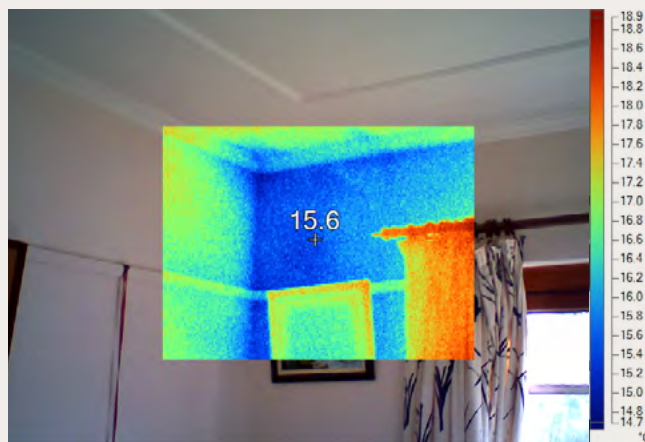
In evaluating whether an advisor is right for you, ask about their experience and understanding of construction costs, and whether they regularly provide optimisation services and advice on cost-effective improvements (some assessors mainly produce minimum-standard Star ratings for clients who just want to tick that box).

If you want to get into the nitty gritty and understand exactly where your home is leaking energy, an air leakage test with a blower door and/or a thermographic assessment of the building envelope with a thermal camera by an experienced assessor will help you identify the problem spots.

TO DOUBLE-GLAZE OR NOT?

Too often, when people want to make their house more energy efficient, they talk first about getting double-glazed (or even triple-glazed) windows. This is usually the most expensive part of a thermal upgrade – certainly not the most cost-effective place to start.

Let's be clear about two things: first, double-glazed windows do improve thermal performance. At Light House we use only double glazing in our new builds in Canberra, and also in the vast majority of our renovation work. But second, they are only helpful if your house already has a moderate level of energy efficiency. If you put in double glazing but don't fix other



↑ Thermal imaging shows up issues like cold transfer through this uninsulated double brick wall (see case study #1 on page 63 for more on this project).

problems like poor insulation and lots of air leakage, you're in for a disappointment. The benefits won't be as big as you imagined.

The reason is easy to understand if we think of the least efficient building I know: a barn. Let's imagine that Farmer Jo wants to convert her old barn into a secondary residence for her mother. She puts in double-glazed windows but finds that mum is sweltering in summer and freezing in winter. We all know why the plan didn't work: the barn is draughty and has no insulation. What's true for Farmer Jo's barn is true for your own home (although hopefully to a lesser extent).

Before considering windows, make sure you've got the building envelope working well: it should be reasonably airtight and properly insulated. These things cost a lot less than new windows and they make your house much more pleasant to be in, but they are not nearly as 'sexy' because you can't see them.

DRAUGHT SEALING

When retrofitting for thermal efficiency, draught sealing really is number one in terms of 'bang for buck'. It is very important not to confuse draughts (or air leakage) with ventilation. They are very different things; you want both good airtightness and good ventilation. 'Build tight and ventilate right' is a common mantra chanted by building scientists. Air leakage is random, uncontrolled air movement via permanent gaps and cracks. It means you lose heat in winter and gain it in summer. Ventilation is air movement that you design for and control: it happens when you open a window, door or other vent at times when you judge it to be helpful.

The best way to find the draughts in your house is to pay for a blower door test. This will set you back a few hundred dollars as a one-off cost, but you'll know exactly how leaky your home is and where the major problems are – they are detected during the test by feeling airflow by hand, using a hand-held smoke



↑
Optimising window size and placement is a good idea if you're doing your thermal retrofit as part of a broader renovation. Here, windows facing south and east were reduced in size by infilling part of the openings with insulated wall.

puffer or with an infrared camera. Then, if you're handy with tools, fix the gaps yourself with the wide range of gap sealing products available at hardware stores or find a trusty local handyman.

If you're worried about sealing the draughts because your home will get stuffy, then you don't have enough ventilation. Do your windows open? Can you get cross ventilation? Do you have good exhaust fans in your wet areas? If not, then consider fixing that, because venting your home with uncontrolled draughts is no way to live.

INSTALL OR REFRESH THE INSULATION

After draught sealing, insulation should be the next thing you investigate. Maybe you want to skip this step because your house already has insulation? But how old is it, and how effective is it? (The performance of insulation is expressed as an R-value, with R1.5 to R6 being common in Australia; you should have insulation with a value at the higher end of this range in your roof space, for example.) Is your existing ceiling insulation nice and evenly laid out up there? Or are there gaps, perhaps where a tradie once went into your roof, moved batts around, and didn't put them back at the end of the job? I'm betting that it's less than perfect. I've inspected a lot of homes and crawled in a lot of roof spaces, and in my experience houses with perfect insulation coverage are not typical. Get it checked, and get it refreshed.

As a rule of thumb for insulation, start high and work your way down. In other words, ceiling insulation is your priority,

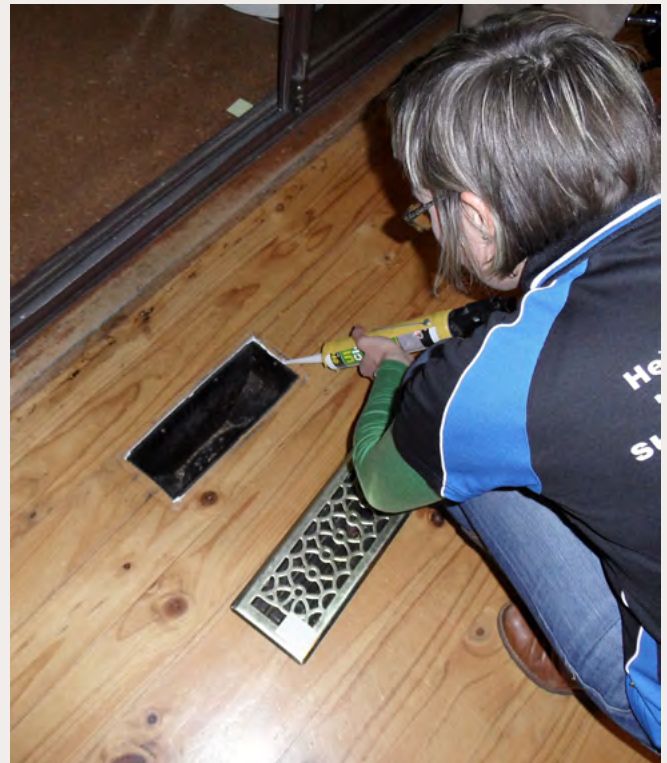
then walls, then floors. The construction of your home may make it hard to top up or add insulation. For tips, read the insulation buyers guide in *Renew 140* and 'Insulation in tricky spaces' in *Sanctuary 19*, and get expert advice from an experienced insulation installer.

OPTIMISING WINDOW SIZE AND PLACEMENT

If you are doing your thermal retrofit as part of a broader renovation, or if you are intending to replace the windows, consider changing their configuration.

The first principle here is to reduce the area of glazing facing directions other than north. If you have lots of glass facing east or west, it can cause your house to overheat in summer. You don't have to get rid of those windows, especially if they have nice views, but you might want to reduce their size. On the other hand, if your house is cold in winter and you have little north-facing glass, consider putting more in (or enlarging the windows that are there).

Compared to the fixes suggested earlier, this one is more costly. Reconfiguring window size and placement is major work. It will also change the look and function of your home, so don't go for a quick 'Bob's your uncle' kind of fix. You will need a builder, and you should get advice from an architect and energy assessor too.



↑
When you're aiming for energy efficiency, comprehensive draught sealing is number one in terms of 'bang for buck'. Don't forget to seal around heating ducts and other floor, wall and ceiling penetrations.

WINDOW DRESSINGS

If your windows are a problem but your budget is tight, then good window dressings (curtains or thermal blinds) are worth considering. The key thing is that you don't want air movement between them and the window – they need to fit snugly. In summer, the air next to the glass will get hot, rise up, and then circulate through the room; in winter the opposite happens. The trick is to have a pelmet to break that air movement, or to use a type of blind that is effectively sealed at the top. I've seen people on a very small budget use cardboard between the top of the window architrave and the curtain track, and it worked well.

EXTERNAL SHADING

If you are baking in summer, check to see if the sun is striking your windows. Eaves, pergolas or horizontal shades above windows can be used to prevent sunstrike to north-facing windows as the sun is high in the sky to the north. Windows facing east and west are struck by the sun when it is at a much lower angle so vertical shading is required – retractable blinds and awnings, or shadecloth that you take down over winter. You're aiming to provide shade in the summer but maximise the free heat from the sun in winter (especially in cooler climates).

CONCLUSION

Your house might be cold in winter, hot in summer, guzzle energy, and be uncomfortable, but don't assume that it can't be salvaged. A retrofit may well get you a great outcome for much less money. And, if you do retrofit, don't assume that the expensive solutions (such as windows) will necessarily be more beneficial than the cheap and easy solutions (such as window dressings and draught sealing). Get some help with decision making – there are design and building science professionals who can provide objective advice. You deserve to be comfortable in your home all year round, which might be easier to achieve than you think. 📍

FURTHER INFORMATION

NatHERS Assessors:

- Design Matters designmatters.org.au
- ABSA absa.net.au/find-an-assessor
- HERA hera.asn.au
- ACT licensed assessors bit.ly/ACTBuildingAssessor

Registered airtightness testers:

- The Air Tightness Testing and Measurement Association bcta.group/attma/members/air-tightness-testers/australia

Webinars by Jenny on retrofitting:

- Renew - Retrofitting for Energy Efficiency and Comfort youtu.be/hBVdyOB6cgU
- CSIRO - Renovating and retrofitting for sustainability (from 17:30 minute mark) ahd.csiro.au/renovating-and-retrofitting-for-sustainability

THE PRINCIPLES IN ACTION

Two Light House Architecture & Science renovation projects neatly illustrate what's possible when energy efficiency and thermal comfort are the priorities. More information about the projects can be found in Jenny's recent webinars; see 'Further information'.



#1: 1940S COTTAGE UPGRADE

This double brick cottage was built in the 1940s on a large block in inner Canberra, and extended in the early 2000s. The homeowners had lived there for 29 years and wanted to stay into retirement, but it was very cold over winter which aggravated their health issues. They thought the only way they could be comfortable was to build a new secondary residence out the back to move into when they retired, and they asked us to investigate this possibility.

It was possible but it came with a substantial price tag of between \$350,000 and \$450,000. Another option was a significant renovation and extension of the existing home to create two houses in one – also doable but also at a hefty cost.

We studied the home further and modelled its energy performance and concluded that it was possible to improve its thermal performance massively and quite cost-effectively. We suggested to the homeowners that they try some simple, relatively inexpensive solutions first, and if that didn't work, then proceed with a major renovation or a new residence.

Our recommendations focused on draught-sealing and insulation. We conducted a full assessment, including blower door testing and thermal imaging, so we could advise them exactly what to fix and where. The clients were sceptical, but they gave it a go. They spent around \$15,000; this included our testing and advisory services plus gap sealing under doors and behind appliances, improved insulation especially around light fittings, and new curtains.

We returned several months later, tested air leakage again, and discovered the clients had reduced it by 50 per cent. Their energy bills for winter 2020 were down by nearly half on the

previous year (despite working from home during the Covid-19 lockdown), equating to a \$300 saving each quarter. They also had lower bills over the summer of 2019-2020 when Canberra experienced serious heat waves and terrible smoke-filled skies. Most dramatic though was their improved comfort – they now want to stay in the home as it is, and no longer have plans to knock it down, extend it, or build a secondary residence.

They have volunteered their backyard to be part of a fabulous community urban farming project, and so instead of a new building taking up their land there are very happy chooks and a large thriving veggie garden.

You can read more about the clients' experience in their own words here: bit.ly/TurnerCottage

Image: Ben Wrigley



#2: THE 'FABODE'

We nicknamed this house the 'Fabode' because the owners have Fab in their name and we think the outcome of the retrofit project is fabulous. This original-condition 115-square-metre 1970s home had good bones but very poor internal layout and was in need of some serious maintenance. Our clients' family and friends all thought they should knock it down and rebuild a much bigger and 'better' modern family home. The owners didn't think they needed a bigger house and hoped the existing building had untapped potential. They were right!

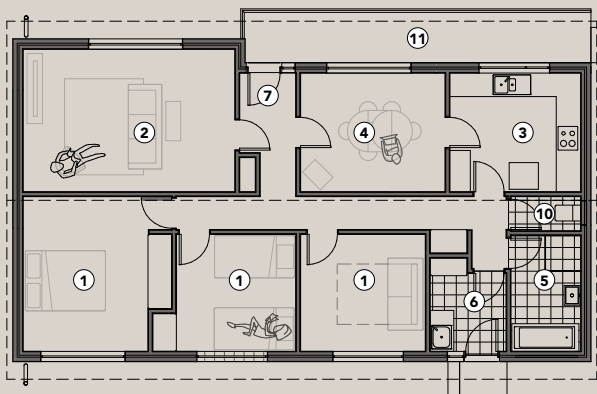
We gave it a complete makeover, incorporating but going

beyond the kind of changes discussed in this article, including a complete change of floor plan – but we did not extend. The house felt poky and disconnected: a bunch of isolated rooms with the living areas at the front, disconnected from the garden. This layout reduced the house's functionality and blocked the opportunity for cross ventilation and the potential for visual and physical extension of the living areas into the outdoor areas. Connection to the outdoors is one of the keys to making smaller homes work well. The renovated home has an extra bathroom, study nook and living area and feels much larger, despite not growing the footprint at all.

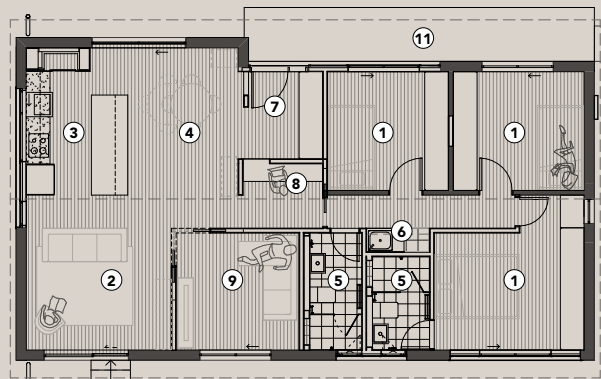
Instead of virtually no insulation, the house now has excellent insulation. Instead of being super-draughty, it is now very airtight (about five times more so than a typical Australian home, without the use of any internal air barrier membranes, just plasterboard lining and good detailing). Windows were upgraded from single-glazed aluminium frames to double-glazed uPVC and the location and size of some windows in the living areas were modified to improve thermal comfort. The family's energy bills have plummeted and they are comfortable all year around.

You can read more about the house here: bit.ly/Fabode

EXISTING FLOOR PLAN



NEW FLOOR PLAN



LEGEND

- ① Bedroom
- ④ Dining
- ⑦ Entry
- ⑩ Toilet
- ② Living
- ⑤ Bathroom
- ⑧ Study nook
- ⑪ Porch
- ③ Kitchen
- ⑥ Laundry
- ⑨ Multi-purpose room