The journey from schoolroom to home
A tour of reuse

Andy McLeod set out to build a 'spec' home using portables as the shell. His building journey highlights many of the opportunities—and challenges—of reuse, finds Robyn Deed, on a tour of the almost-completed home.

WHO would have thought that the humble portable classroom could be transformed into an 8.1 Star home?

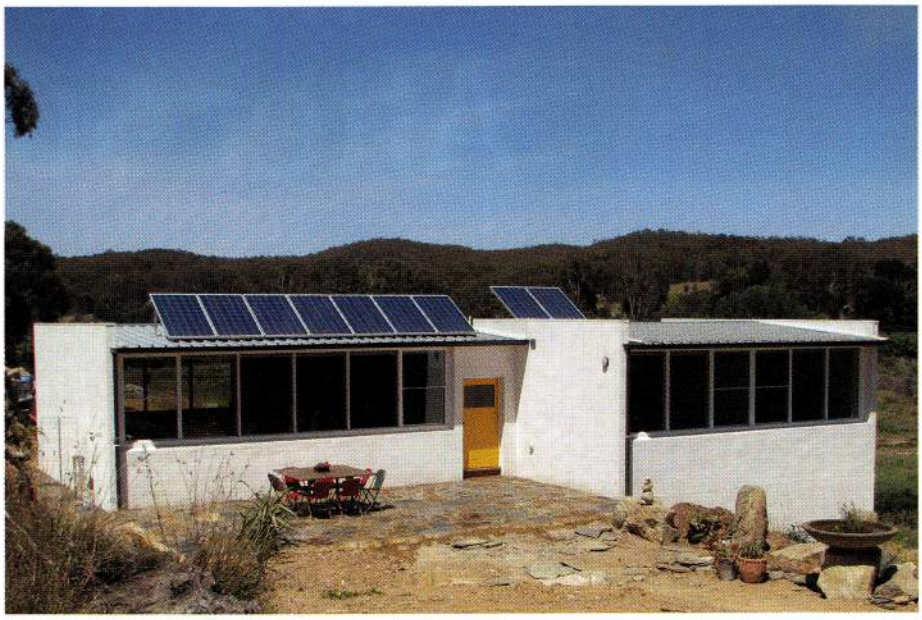
Architect and builder Andy McLeod has done just that, using two portable classrooms to build a lovely passive solar home for himself and his partner, Ambah O'Brien, in Chewton, Victoria, a small town near Castlemaine.

The classrooms' arrival at the site sparked criticism from locals. It's an old area, so something modern caused some waves. Since then, the lime render has gone on and people are less critical, though as Andy says, the look is still significant—it's striking, two glowing white cubes, jutting out of the hillside as you come under the railway bridge from town. It's definitely not faux Victorian, a style that Andy says "rattles my cage."

They are hoping that new plantings around the house will also help soften the look. They've planted nodding saltbush, native geranium and grasses, plus a line of wattles specifically to soften the view—all local plants, selected with the help of a local seed collector.

The steeply sloping site caused some problems for the build. An existing reef of rock dictated the placement of the portables, with excavation needed to level parts of the site. Andy says, "It took two days to break through one small area of rock."

Alongside stone "so hard it doesn't chip with a hammer on an excavator", they found large quartz crystals, black shale and litter such as pick heads and pottery shards. The latter probably date back to gold prospecting days, with diggers' tales of small nuggets of gold found in the black shale. Evidence of blasting suggests a more recent use of the site as a stone quarry.



Photos: Andy McLeod

↑ The 8.1 Star home is built from two portables linked by an airlock which acts as the entry hall. Simplicity was key to the design with the roofline extending across the entry hall between the two portables.

Stone in construction

They've used rocks excavated from the site for a retaining wall. The huge rocks are fantastic for retaining walls, placed offset with earth spilling through, Andy notes.

He's a big fan of local stone in construction: "It's environmentally durable, has low embodied energy and is the perfect building material. It's seen as mining though, to quarry stone, and so there are detractors." He believes it's no more of an issue than digging up earth to use in bricks. Another plus to him is that there's no treatment required.

That said, the slate they've used in the outdoor area is from China. They would like to have used local Castlemaine stone but at three times the price, they couldn't justify that expense.

Portables as shell

He's a big fan of the portables, too. "They're a good shell and easily insulated." It's labour intensive to use them, but most of that is less skilled labour, so that DIY is possible.

They had initially planned for this to be a 'spec' home, a design they could reproduce for low-cost, environmentally friendly housing. However, it turned out not to be as low cost as they'd hoped, so they've decided to live in this home for a while instead.

"I like the idea of living in houses you design," he says. "There are an infinite number of options when it comes to sustainable design and so it's a chance to experiment and see the results." He likes building for himself because he can make mistakes or try things out. "You're free to learn," he says.

↑ Half a portable being craned into position (above), and the two portables installed (right).

They sourced the portables from BRB Modular nearby in Kyneton; you can see the field of portables as you drive along the Calder Freeway towards Chewton. BRB specialises in modular construction and also provides second-hand schoolroom portables for use in schools and temporary buildings—and builds such as Andy's.

The portables he sourced were, he thinks, from around the 1970s, and most at BRB are about that age. One question that arises is that of asbestos in buildings of that vintage. Andy says, "Some of the portable designs did have asbestos in them, but BRB removes it before selling them. I think they're required to do that."

The two portables cost about $5000 each, and transportation plus craning them into position cost another $5000 each—so $20,000 total. In choosing a portable, he says that the quality of the roof is a good thing to consider. If the roof isn't damaged, you can expect a good saving on your building costs. He also notes that portables from coastal areas may have issues with rust in the metal used in the roof and sub-frame.

They did need to replace the ridge caps as, he says, "they get trashed during transportation." He adds, "You'll also usually need to replace the gutters and downpipes."

He is enthusiastic about the cleverness in the design of portable schoolrooms: "There's a lot of efficiency in the build. They'd really worked out their modular nature: the capacity to be moved in two halves, in 3.6 metre widths which fit on a semi-trailer."

There's a substructure of steel that bolts the two halves together. You do get damage around that join. For example, in these portables some of the floorboards near the join needed to be replaced.

Andy thinks that passive solar was part of the original design. The opposite sides are glazed, with the eaves perfectly proportioned to exclude summer sun, if they're oriented with windows north and south. Plus there's good cross-ventilation with the opening windows. We usually think of them as hot boxes in summer, and freezing in winter, but Andy says that's partly because schools always seem to place them with the windows facing east and west. (I think about it, and that's exactly right for my son's school!)

They're also not well-insulated, but, he says, as soon as you insulate and seal them properly, they perform fantastically.

He sees the portables as an example of "an engineering rather than a design mentality." That's something he's passionate about. He believes that the freedom that technology has given designers has meant that architecture has become wrapped up in being façade-driven; it's all about the impression rather than the function.

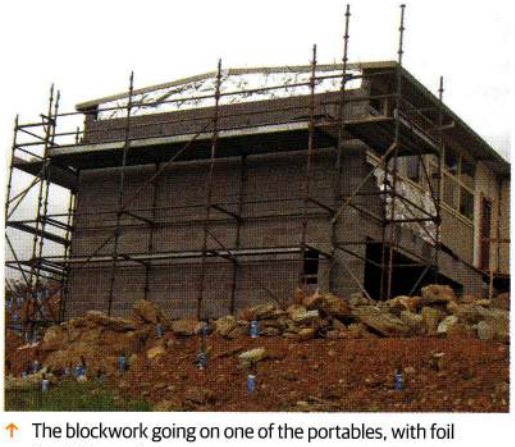
He says, "You look at this house and it's clearly a passive solar design, and I like that." As a design aesthetic, he thinks that's more humble, driven by intent rather than ego. He says, "Everything is driven by ego but...I look at a lot of architecture and reel. I love Gehry, but imagine if he had an intention to create human-scaled spaces, sensitive to breeze and sunlight, instead."

Encased in blocks, and rendered

The portables have been encased in concrete blocks. Andy believes these are a good choice, environmentally. "Blockwork—per kilo—is quite a moderate masonry unit in terms of embodied energy. Using mud bricks is ideal but as soon as you transport them you've got issues," he says. "Concrete blocks are incredibly quick to lay and simple to build a structural system from; I love them!"

"I like the idea of living in houses you design. It's a chance to experiment and see the results."

The block cladding creates a cavity for insulation. The 100mm cavity between wall and portable holds a 75mm R1.8 glass insulation blanket with a reflective surface to the exterior. The radiant barrier reflects heat rather than acting as a conductor, and thus reduces the influence from extreme temperatures. Its use requires an adequate air space (25mm in this case) and placement is dependent on climate. Bulk R2.0 Green Batts have also been placed in the 90mm cavity of the portables' timber-framed walls.



↑ The blockwork going on one of the portables, with foil insulation underneath.

↑ The PV system monitor is built-in—in a cupboard in the entry hall—with the hooks below it reused from the portable classrooms. The 2 kW PV system is generating around 10–14 kWh in October, against usage of about 5–6 kWh for this all-electric house (usage will be higher in winter with heater use).

↑ Cross-sawn timber kitchen cupboards and the recycled oregon timber benchtop are a feature of the open-plan kitchen/living space—along with just a small fridge space.

"The lime render changes colour according to the light; in the moonlight, Andy says, it glows a soft purple."

Radiant barriers are the "king of insulation" when placed correctly, Andy says. "Bulk insulation will eventually transfer heat, but radiant barriers are always working."

The exterior of the building is rendered with a 10 mm lime layer, which is "great at obscuring the substrate"—in this case, the concrete blocks.

One of the advantages of lime is that it remains reactive after application; it swells as it gets wet, protecting it to a degree. A concentrated flow of water would eventually erode the surface so Andy notes it's important to move the water away from the walls.

Lime also fixes its CO_2 contribution as it cures, Andy explains: "The process of kilning at 1100 °C and slaking to produce the lime paste releases CO_2, but as the lime render slowly turns back into calcium carbonate—limestone—after being applied, it fixes up to 90% of that CO_2."

It's a beautiful surface, with texture from the trowelling, sponged rather than smooth. It changes colour according to the light; in the moonlight, Andy says, it glows a soft purple. The sponged surface will reflect some heat, but it's been used more for aesthetic reasons.

Inside the house

The two portables are oriented offset from each other, with an airlock in-between. The airlock is the entry hall—an unconditioned space which prevents the outside hot/cold air from entering the living spaces and bedrooms, and the internal air from escaping.

One of the portables houses the open-plan living room and kitchen, and the other the bedrooms and bathroom. They've broken the roofline with parapets that allow the gutters to be continuous across the airlock: Andy says, "Simplicity has been key to this whole build."

The back and front entry doors use the old schoolroom doors. They're wider than your usual doors (perhaps to allow the hordes of children easy passage in and out in their original school use!) They've used recycled commercial closers so they close automatically on entry and exit. Andy says, "Sometimes I like the idea of conscious use [that you have to close the door behind you] and sometimes I like the idea of being without option, that the building just functions."

The doors are lovely, and are being painted in bright primary colours when I visit—perhaps also reminiscent of their heritage!

On the wall to the right as you enter is a row of hooks, also salvaged from the original portables. Above the hooks, in a purpose-built cupboard, is the PV system monitor. It's great to see it as you come in and get a readout of the kilowatt-hours generated by the 2 kW grid-interactive solar PV system. Yesterday the system produced 10.9 kWh, 14 kWh the day before. He says, "Not bad at all in mid spring."

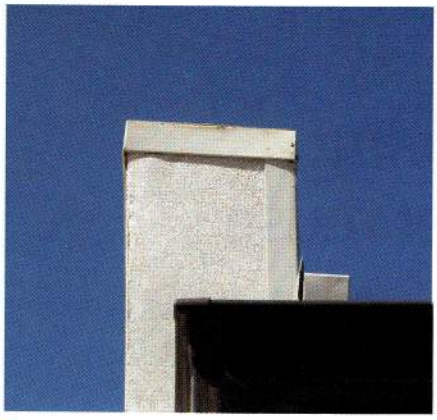
To get to the living area you go through another door with recycled self-closing dampers. These internal doors are also lovely, made from recycled oregon, joined together in strips with metal T-junctions used to hold the pieces together at the top.

The kitchen cupboards use a recycled carcass: someone local was upgrading their kitchen, so Andy and Ambah scavenged it and the carpenter, Stuart Reed, reconfigured it, adding Tasmanian oak doors. The doors are new wood from an old sawmill that's closed down; wood that had been "sitting around for about 20 years." The timber on the doors and benchtop is streaked with black—it's cross-sawn, Andy explains. It's striking and beautiful, though Andy is starting to have his doubts—maybe it's too strong. He says, "We wanted something interesting, a real feature as you come in, but sometimes you get ambivalent about things." (He calls back after moving in to say they're both now very happy with it!)

They sourced the timber for the benchtops from Dunnolly wreckers. It had sap injuries, which they wanted to show rather than hide, to keep a sense of the wood's nature. They used a clear resin to fill in the knots, but it went a bit cloudy as it set. Andy says almost wistfully, "We could have put in red to make it really glow."

Andy got his carpenter to select the recycled timbers, and he recommends that

↑ Installing the false ceiling.



↑ The parapet cap sheds moisture away from the walls.

approach. The straighter and truer the better for recycled timbers: he says, "The carpenter has to work with them, and Stuart has an excellent eye. It's easy not to understand how much timber moves, and how where it comes from will influence that."

All-electric

They've gone all-electric with the appliances, including an induction cooktop, with a rangehood also from the reused kitchen. As an example of forcing energy efficient behaviour, they've left a space for only a small fridge.

The only cooling systems are fans and cross-ventilation from small sash windows. When I visit, Andy's concerned about the brush seals on these windows, with about 3 or 4mm of play when sliding them up or down. (A couple of weeks later, after moving in, he emails to say that it's not a problem—the windows are working well, with very little air movement.)

Most of the other windows are Sunergy double-glazed, fixed (non-opening) windows. Double glazing becomes much more competitive in price when bought as fixed panes without frames, he notes.

The building doesn't have thermal mass to hold heat in the room, so they've installed two 2000 watt Nobo panels for heating. They don't anticipate prolonged use to heat the well-insulated space. Andy says, "Time will prove whether these heaters are an efficient choice." I ask him if he's thought about using a heat pump air conditioner for heating, but he prefers not to have moving air for space heating. "Blowing air is cold air as far as I'm concerned," he says.

They've put in a false ceiling to hide the trusses and provide a deep cavity to keep insulation clear of the recessed downlights. They've used LED downlights from LEDCentral which use Cree LEDs, produce 600 lumens and cost about $65 each. He says, "We've under lit this place a little, and we'll probably add some feature lights, but that's another behavioural thing, to reduce electricity use for lighting."

Other features

Other features of the build include separated grey/black water and a Quantum heat pump for hot water. Andy was interested to get a chance to trial the heat pump system. The heat pump HWS extracts and concentrates heat from the air to heat the water. They've sited it so that it draws air from the sub-floor garage, with the earth acting as a moderator of temperatures. Andy is interested to track how much energy it does use (and we hope to follow that up in a later issue of *ReNew*).

They installed a 270 litre tank for the HWS as they thought that size would be "more endearing to a mass market." He would have preferred the 150 litre unit for himself, given its lower energy use, but the lower volume would dictate usage patterns.

Costs and viability

Overall the build cost around $300,000. "A bit more than planned," he says. When they embarked on the project, he thought it would come out at around $150,000 to $200,000. But the site's been tricky, and they had a wet winter, so it's been a struggle.

Would he recommend reproducing the idea, or would he be doing that himself? "I'd dissuade people from doing it to save money unless they have the labour and skills to do it themselves."

From a commercial point of view, he thinks he could have a greater effect with regards to sustainability for less cost if building from new. "But if you can do it DIY, it's a great opportunity," he adds.

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There were site-specific difficulties, including the need for the garage retaining wall, and a complex footing system, all of which added to the costs.

But there were problems with using the portables, too. They get twisted from being transported and they had to wrack them back into plumb. They also needed to add external mullions so the glazing could sit square.

Could it have been done for $200,000 if they didn't have the site and basement issues? He says, "Yes ... maybe ... at a stretch." It's just a lot of labour, and he adds another problem: "The floor joists were loose and we had to pack and tighten those; there's still a small creak in the floor." It's clear there are issues that arise when trying to reuse something like this that's had a long former life.

On the way out, he points out the balustrade for the front steps. He scavenged it from eBay at a good price—$90. But he spent four hours each way in the car to get it. "One of the traps of eBay!": it was listed for pickup in Melbourne, but it turned out that meant the other side of Frankston.

At the front gate, there's also a pile of beautiful sandstone boulders excavated from the site. While I'm there, Andy gets a call: it's the project's carpenter, arranging to pick up a truckload of the rocks. "It's all part of the process of give and take in a small community like this," says Andy, "plus it means we don't have to double handle them."

Next to the rocks is another example of give and take: a stack of PVC tubes that someone had in their shed and passed on to Andy. The tubes are for earth-tube cooling in his next build. With so much reuse in this house, it seems apt as I leave to find another example of reuse just waiting to happen. ✱

Andy McLeod is an architect and the owner and builder of this home. solarchitecture.com.au.