

Sustainable strawbale

Martin Freney shares his experience of how a storage shed evolved into the perfect passive solar strawbale home

Inspired by the teachings of the Food Forest Permaculture Design Course (PDC) in January 1999, my partner Zoe and I realised a sustainable lifestyle was both possible and within our grasp. By August 1999, we had purchased a 1.5ha sloping block of land in Ironbank, South Australia, and it was on this land we decided to establish a more ecological way of living. Our goals were to build a home using environmentally sound materials (salvaged wherever possible), to minimise pollution by reducing our energy consumption, and to grow as much of our own food as possible (for health, reduced food mileage, pesticides et cetera). This was it—our blueprint for living happily in an increasingly weird world.

Our block of land, facing NNW, was ideal for establishing a small permaculture ‘farm’ and it took about 12 months, until July 2000, to level the site and build a seven metre by 12 metre shed. The shed would be our home for a year and a half and a storage facility for salvaged building materials for our yet to be designed house.

Research and design

After sketching hundreds of floor plans and reviewing countless eco product pamphlets, we decided we needed help. In early 2001 we enlisted the services of local ecological practitioners, architect Bohdan Dorniak and structural engineer Gerald Wittmann. We had fallen in love with the thick, curvaceous, organically aesthetic, insulating properties and DIY potential of strawbale walls and so decided on a strawbale construction with composting toilet and reed bed treatment system, and of course,



Martin, Zephyr and Zoe in front of their healthy and environmentally-friendly home.

passive solar design.

Not being connected to the sewer system and recognising there is no such thing as waste, choosing a compost toilet was a simple matter. The reedbed system required no contracted maintenance plan, no chemicals and was entirely DIY.

The passive solar design would keep us warm in the winter and cool in the summer, with minimal active heating and cooling and significantly reduced energy use.

We initially intended to build the house from scratch but in a bizarre twist to the plot we decided instead to convert the shed. It was perfectly located, facing north, high on the sloping block near the access track and already had electricity, water and telephone connected. We scrapped our original plans

and gave Bohdan a brief to convert the shed into a house. One of the benefits of living in the shed for almost two years was that we got a great feel for how the block ‘worked’—where the wind blew from, where noise came from, where the sun rose/set, and where shadows were cast by tall trees. It was clear that the shed was where the house should be. We set about building another shed so that we would have somewhere to store salvaged building materials.

Within a few months we had a set of plans prepared. Then insurance company HIH collapsed and our building contract fell through! What now? We decided to become owner builders. We had always wanted to have a lot of involvement with the building process so we could easily salvage materials and

building components and incorporate them into the house design. Here was our chance. We were also hoping to save money and this made it possible for us to ‘tweak’ the plans without great expense. As an industrial designer I could not resist fiddling with the floor plan, location of the cool cupboard, the roof-line et cetera. My technical drawing and design skills were very useful, as I spent many hours making minor alterations to the plans before submitting them to council for approval.

Approval

The City of Onkaparinga council was quite receptive to our development proposal for a house with straw insulated, concrete-rendered walls. But they were openly surprised and bewildered by the reedbed and composting toilet which we soon found could (and should) be handled by the Department of Human Services (DHS).

A private certification authority (Karnich Dodd Pty Ltd) was enlisted to certify the building application to avoid hassles with prejudice about strawbale houses. The Country Fire Service (CFS) was also consulted and had no problems with the house. As long as it had 22,000 litres of fire-fighting water, water pump, sprinklers, hoses, 14 metres of clearance from trees et cetera, they were happy. Thankfully, Bohdan had recently organised and supervised



CSIRO testing of strawbale walls that proved strawbale is okay in bushfire zones, which meant that we no longer had to clad our walls in concrete. What a relief, as we wanted to use the terracotta coloured clay from our excavated site.

Finance


We needed a bank loan and had surprisingly little difficulty in borrowing \$150,000. I think this was due to the fact that we owned the land outright which we used as collateral. About another \$30,000 got pumped in (my salary) over the course of the building process.

Originally, we naively asked for just \$80,000 so had to go back twice more

for extra funds. Some of the things I failed to budget for were equipment hire (including six months scaffold hire—we should have bought some secondhand) and all the little stuff that just seems to add up: screws, tools, paint; it became a huge list of tools and materials.

Strawbale wall building

The farmer that grew our straw stored the bales for about six months as we were not ready to have them delivered. Eventually though, in early 2002, he needed to get them out of his hair and so we had to store them for about another six months until we were ready to use them. It was very important to




DesignEco
Australia's Newest Solar Hot Water System

- Factory direct \$2595 – less with Govt. rebate* Delivery and installation extra
- 400 litre tank, two panel split system with temp. controller
- Low profile roof mounting
- Engineered in Australia, AUS standards approved
- 5 year warranty

*Rebates of up to \$1564 are avail., subject to Fed. & QLD conditions and dependant on existing system.

office@designeco.net ph: 0432 887 590 (QLD)



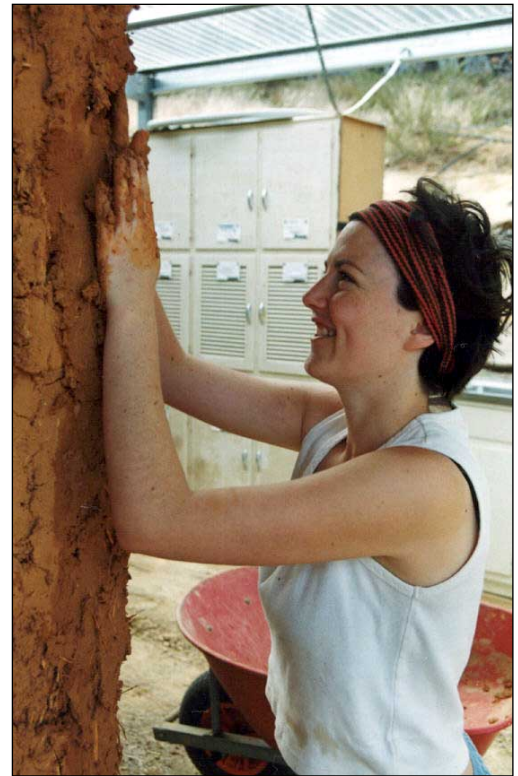
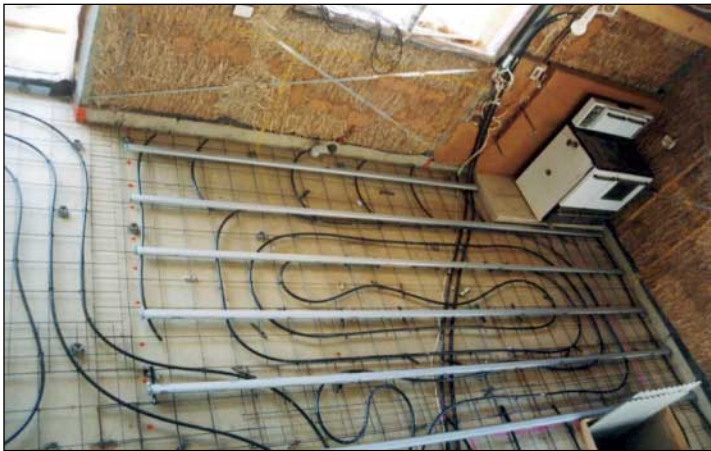


AFFORDABLE WINDPOWER

- Simply installed
- Able to pump to 80m (250') head
- No expensive rebuilds - approx \$40 parts
- Low maintenance
- Capable of pumping up to 18 l/min (4 gal/min)
- Auto turn-off in high winds
- Aesthetically pleasing
- 3m (10') or 4.5m (15') towers available



Oasis Windmills
30 Baldock St Dookie VIC 3646
Ph (03) 5828 6452
mob: 0418 340 717



Above: Zoe applying some of the 40 tonnes of render to the outside walls. **Top left:** The in-slab floor heating system was installed before a concrete topping was poured over the existing shed slab. **Left:** The bathroom's stud walls before being 'baled'.

keep them well wrapped up with plastic and we set many mouse traps; the weather and vermin are a big threat to un-rendered strawbales.

Lance Kairl, one of South Australia's most experienced strawbale builders, was consulted often throughout our owner building project. He also had a lot of input and discussion with the architect during the design phase. Lance was on site for our weekend 'wall raising' in November 2002, which many friends and family (and Bohdan!) helped with. It was a weekend of fun and all went smoothly on account of Lance's supervision.

The wall raising only took a couple of weeks to complete, and in the same month we also managed to construct our ceiling (galvanised custom orb) and install a 1500 watt PV system. One advantage of an earth-rendered strawbale

wall is that you don't need to use chicken wire on the walls, only around the windows and doors where the bales have been cut to length. However, the three coats of render (40 tonnes of sand and clay) took us about a year of weekend rendering. We investigated the option of spraying the render on but at that stage there were no local render spraying contractors (I think Lance has one now).

After the final coat of render had dried, we sprayed on a solution of potassium silicate (water glass). I think that it was too thick and didn't soak in far enough, creating a thin and brittle two millimetre layer on the surface of the wall which is susceptible to water damage. As a result we are having some problems with the northern wall which is hit by the full force of winter rain funnelling up our valley. Experiments

with mixing the water glass into the render (rather than spraying) have been more successful but I would be interested to hear from others regarding their solution to this problem. I have some maintenance to do.

Materials

We had gone to great effort to salvage some doors and windows from an old mansion that was being demolished on the Glenelg foreshore. A friend was renting it and put us in touch with the new owner/developer. We carted off all the windows and doors, power points and light switches that we would need—all for about \$1500!

But disappointingly, we found that the Australian Standard for Construction of Buildings in Bushfire-prone Areas (AS3959-1999) deemed that our windows were unsuitable because they

were not made of a hardwood. We traded them with our friend Ray (who we met at the Food Forest course) for his electrical services.

We used the salvaged doors as they seemed to be made from a hardwood and many of them were for internal use so did not need to be fire resistant. We commissioned a local joiner to manufacture double-glazed jarrah single sash windows, and one large sliding glass door. Beautiful, but expensive (about \$23,000) and I'm still not happy about the impact on the West Australian forest that it came from, but the upside is that they are strong, durable, energy efficient and will bring us great joy for the life of the house—hopefully longer than my lifespan!

Other salvaged materials included jarrah floorboards which we have used in the kitchen and bedroom, pine timber for the stud walls, all the kitchen cupboards (some very funky art deco numbers), the claw footed bath (free from a friend and restored for \$1000), the wood oven, red brick pavers, and the proverbial kitchen sink. The cladding for the bathroom wall was taken from the original shed.

Results

Our electricity bill is about \$20 to \$40 per quarter in the summer and about \$200 per quarter in the winter. Most of this is on boosting the solar hot water.

The solar hot water system is fantastic in the summer but still needs a nightly 'off-peak' boost in the cooler months. We have insulated the tank with astro-foil which has reduced the nightly temperature loss from 14 degrees to approximately four degrees, but this depends a lot on the outside air temperature.

When it is 45 degrees outside it is 30 degrees inside which is too warm for comfort, so sometimes we use a small portable evaporative air conditioner—

House Features

- 1500 watt grid-connected photovoltaic system—Kaneka thin-film amorphous 27 panel (3 x 9) array. Approximately \$13,000 after \$7,500 rebate.
- 330 litre solar hot water system (with frost protection system)—twin panel, roof mounted tank, frame mounted at 30 degrees to improve insolation.
- Reedbed water treatment system—using roto-moulded polyethylene plastic tubs (manufactured by TeamPoly), designed by Chas Martin of Soft Technology. Treated water is used to irrigate the fruit orchard.
- Strawbale walls, earth rendered—10 tonnes of clay excavated from building site (cost negligible), 30 tonnes of sand (delivered). Bales are super dense, specially compacted for strawbale wall building.
- Compost toilet (batch system—Nature Loo)—our poo is now a valuable resource, fertilising our fruit trees, and we are not wasting precious water resources on flushing.
- Cool cupboard—passive cooling for food, especially fruit and vegetables, so only a small fridge is needed.
- Wood oven with 'wet-back'—acts as a space heater, floor heater (via in-slab water pipes), and a regular oven (although we also have an electric oven for use in summer).
- Hydronic floor heating—in-slab floor heating system was installed before pouring a 'topping' over the existing shed slab. Thermostat controlled electric pumps distribute water to various floor areas via polypipe circuits. A manifold in the laundry is used to control which floor area is heated.
- Rainwater storage (approx. 50,000 litres)—supplies the house for at least 11 months of the year, although we can switch to mains supply if necessary. The garden is on mains supply.
- Indigenous species wood lot has been planted to supply wood for heating and cooking.
- Passive solar design—large north-facing double-glazed windows with correctly designed eaves and internal thermal mass (slab floor and rendered walls).
- Permaculture fruit and vegie gardens—already harvesting about 10% of our food needs.
- Alpacas (two)—help to keep the grass trimmed (important for bushfire safety) and provide manure for the garden, wool for clothing and entertainment for the whole family! \$990 for two male lawnmowers (not breeding stock).

we used it on two days during the summer of 2002-2003, which was hot! We open the windows in the evening and there is usually a cool gully breeze that blows the hot air out.

When it is zero degrees or less outside it is still 15 degrees inside—with-

out any heating. The small wood oven easily brings the temperature up to a comfortable 19 degrees in an hour or two. We only burnt about a tonne of wood this winter.

The floor heating system is a small disappointment. Although it is won-

derful to have a warm floor, it is slow to heat up and cools-off too quickly. It must need extra insulation (somehow) to stop the heat from leaking into the earth.

The system doesn't work well under the timber floors, and our small wood oven is only capable of heating one of the six circuits that have been installed, meaning only one patch of floor can be heated at any one time. I am hopeful that powering it with solar water heating technology may be the way to go.

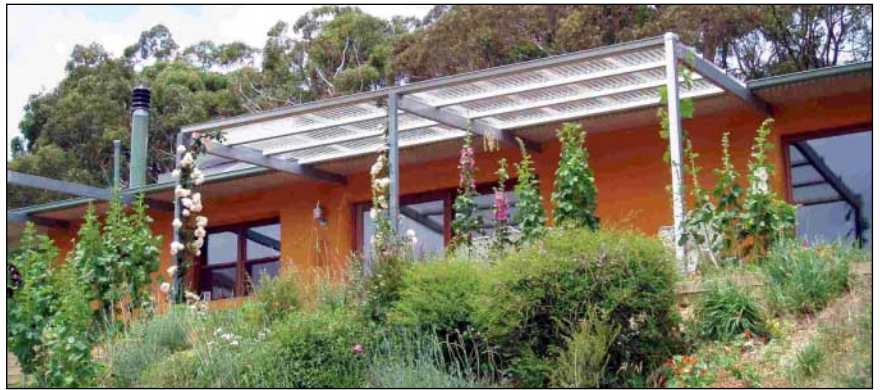
The open plan living space is used for everything and while this is occasionally frustrating, it is more often a blessing; the family is united, interacting and enjoying the open and healthy space together. It certainly helps us keep an eye on our toddler Zephyr while still getting something else done.

The double-glazed windows are excellent but they still get cold to the touch, indicating that there is substantial heat loss. Heavy duty curtains would be a big improvement and would reduce the amount of wood we need to burn to keep warm.

Resources

The most important resource throughout this project was people. Our network of friends, family and colleagues provided much support, encouragement, knowledge and manual labour. Our permaculture and professional contacts were consulted regularly and often they were happy to offer free advice.

My father, a recently retired mathematics teacher, was on site six to seven days a week for over a year! Without his handyman skills, tools, and enthusiasm, I hate to think what would have become of our house. He sure managed to get things square and level and he kept the various contractors on the straight and narrow too!



Reflections

Living in a sustainably-built home is fantastic; the reduced energy bills are very welcome, but mainly, it is the knowledge that you are protecting your family's health, reducing damage to the planet and promoting and supporting ecological technology. Facing the house towards the sun hardly sounds high tech but it can be as simple as that. In total it took just under three years, from building our original shed to moving in to our home.

As a lecturer in industrial design in the School of Architecture and Design at the University of South Australia, I have demonstrated my house to many architecture students and am privileged to work with some enlightened architects/educators. I am very hopeful that these students, the up and coming architects of the future, will make ecological homes accessible to the masses and one day such homes will be the norm. ★

Want to build for yourself?



If you do, then you'll need technical advice as well as regular inspiration and encouragement.

A copy of *The Owner Builder* magazine every two months will provide you with all of that.

Topics are diverse, covering stone, mud brick and straw bale as well as many other materials and methods.

Passive solar design, fixtures, fittings and practical hints are all included. There are also stories about the experiences of owner builders in Australia and New Zealand.

A subscription is only \$38.50 per year (6 issues) which includes postage within Australia.

Also available from newsagents.

The Owner Builder

PO Box 9000, Paterson NSW 2421
Ph/fax: 02 4995 6228
Email: info@theownerbuilder.com.au
www.theownerbuilder.com.au

Now with 12 more colour pages!

NATURAL PAINT

Natural Paint Pty Ltd
ph: 02 6584 5699
fax: 02 6550 4131

- Casein based paint using natural pigments
- Huge range of creative colours
- Non-allergenic for Healthy Living
- Environmentally sound
- Powder form for easy shipping
- Competitive pricing
- Complete Phone Support & Customer Networking



www.naturalpaint.com.au