Recycled materials is one area where the closed loop philosophy can fall down. "We don't know where these materials have been or the content of the finishes used on them," says Quentin. Documentation is important to the true recyclability of the house so he has kept accurate records that identify the material and construction methods used, to enable future generations to recycle it safely and efficiently.

Cradle to cradle

Thanks to the choice of materials and construction techniques, this comfortable family house in western Victoria is almost entirely recyclable.

WORDS Anna Cumming
PHOTOGRAPHY Nic Granleese

ELECTRONIC ENGINEER TURNED builder Quentin Irvine has been interested in 'closed loop' design principles since university, when he read the regenerative design manifesto *Cradle to Cradle: Remaking the way we make things* by German chemist Michael Braungart and US architect William McDonough. When the time came to build a family home on their block of land in the small western Victorian town of Beaufort, Quentin and his partner Katherine decided to go beyond the standard considerations of sustainable building – passive solar design, energy efficiency and use of eco-friendly materials – to ensure that as far as possible, the house would be recyclable at the end of its life.

"The house is made of materials that are technologically or biologically recyclable and is screwed and nailed together. Wherever glues, paints and sealants have been used, they are natural and biodegradable in all but a very few instances," Quentin explains.

He points out that often, potentially reuseable building materials are rendered too difficult or impossible to reuse or recycle by modern construction methods. "As a builder, my jobs often involve knocking down parts of houses. I realised that because of the construction techniques used, the older houses basically are recyclable; these days it's changed and houses are all glued together."

Quentin took pains to stick as closely as possible to mainstream building techniques so that his design ideas would be readily replicable by the mainstream building industry. "If you look up the specifications in the National Construction Code (NCC), often there is a 'screw' option as well as the more standard 'glue and nail' option. Nothing that we did is that 'out there'; it just involved thinking about recyclability at every tiny step of the way."

Built across the width of the block and opening to the north-facing back garden (Katherine's pride and joy), the modest two-storey house is just one room wide to maximise cross ventilation and solar gain. "Beaufort is pretty cold for nine months of the year, so passive solar gain is a priority," says Quentin. "The design is biased towards winter performance, with large northern double-glazed windows and doors to admit winter sun, and plenty of insulation." This attention to passive thermal performance

Large double-glazed windows and folding doors to the north admit plenty of natural light and winter sun into the living and dining space downstairs; removable external shade sails keep the summer sun out, and openable windows on the south are located for easy cross ventilation.

To create a durable yet recyclable kitchen they chose PureBond plywood (which uses formaldehyde-free soy-based glues), Plaspanel recycled plastic panel, recycled timber and cement sheet, all screwed together for easy disassembly. Most of the furniture in the Recyclable House is also designed and built by Quentin following the same 'design for recyclability' principles.

trays that were also installed without glues. Floating decking boards provide the final layer in one bathroom, and pebbles and pavers in the other. "Copper and stainless steel floor trays for bathrooms are mentioned in the NCC, but as hardly anyone does it any more the skills are being lost and it's more expensive," Quentin admits. "But I think of it as an investment, not a sunk cost, as the material is reclaimable, it will still be worth money in the future."

The cedar-framed windows are the one major component of the house that are not readily recyclable, and for future projects Quentin plans to research alternatives more thoroughly. Older style jointed timber frames put together without glue could be an option. He would also consider aluminium frames – although the insulative components needed to ensure such frames are thermally efficient can mean that the material is hard to recycle. "There are also some uPVC options that are very recyclable, and even use gaskets to clip in the glazing, avoiding the need for silicone."

Despite one or two teething problems, the couple has succeeded in their mission to build a comfortable 'closed loop' family home. "We basically built a house that is a whole lot of firewood, reuseable timber and useful materials for a future generation. In the meantime, it's a lovely little place to live in." S

Low-maintenance charred timber cladding is used for the outside; natural timber oils and natural paints were used for the interior. "A by-product of choosing natural materials and finishes for their recyclability and biodegradability is sensational indoor air quality, so this design philosophy is also helpful for people suffering from Sick Building Syndrome or with chemical sensitivities," says Quentin.

The Recyclable House

—Specifications

Credits

DESIGNER
Quentin Irvine

BUILDER
Inquire Invent Pty Ltd

PROJECT TYPE
New build

PROJECT LOCATION
Beaufort, Victoria

COST
$380,000

SIZE
House 152 m², includes deck and stair void
Site 573 m²

BUILDING STAR RATING
7.6 stars

ENERGY RATER
Residential Energy Ratings, Mark Zarzycki

Sustainable Features

HOT WATER
- Red Circle solar evacuated tube hot water system and wetback system connected to the wood burning stove. Electric backup available, rarely used.

RENEWABLE ENERGY
- Roof slope maximises solar PV with a slight winter bias for when the solar panels are installed.

WATER SAVING
- 2 x 10,000L and 1 x 30,000L rainwater tanks
- Garden is drip irrigated.

PASSIVE DESIGN / HEATING & COOLING
- Extensive north-facing glazing; smaller windows to the south
- One-room width allows for good cross ventilation and passive solar heating
- An earth/lime slab for thermal mass is used as a hearth for the wood heater in the living space
- Shade sails are used on the first and second level to shade from unwanted summer solar gain
- Building envelope fully insulated.

ACTIVE HEATING & COOLING
- Pyroclassic wood fire stove with wetback system. Efficient and able to burn softwoods and hardwoods, allowing the opportunity to use offcuts from the owners' building business.

WINDOWS & GLAZING
- Cedar timber-framed, double-glazed argon-filled, low-e from Stegbar; one of few products in the house that is not fully recyclable. For future project, aluminium or uPVC-framed windows will be considered.

BUILDING MATERIALS
- Low-maintenance charred timber cladding manufactured by owners' business: www.InquireInvent.com.au
- Timber: pine, Australian hardwoods, Oregon (Douglas fir), white cypress – 50-50 split between recycled and new timber products. Hardwood timber sourced from the local sawmill, Pyrenees Timber
- Compressed cement sheet
- Gypsum plasterboard, contains no fibreglass
- PureBond plywood that uses soy based glues for cabinetry
- Recycled timber for internal doors, feature walls, joinery
- Insulation Earthwool: internal walls R2.5 batts; external walls R2.5 batts plus air gap between battens; roof R5 plus R1.8 under corrugated steel; underfloor R4; between floors R2.5
- Proctorwrap wall wrap from Bradford Insulation.

LIGHTING
- Pendants instead of downlights to help airtightness chosen to be practical and reduce costs. LED throughout.

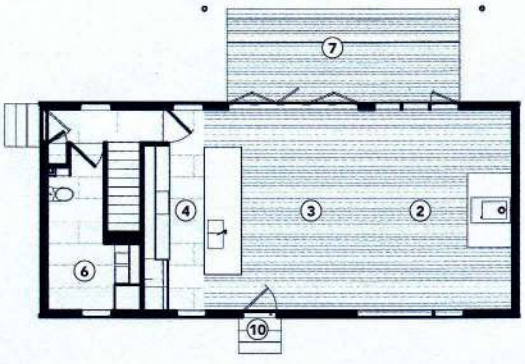
PAINTS, FINISHES & FLOOR COVERINGS
- Bio Products interior paints
- Livos natural timber oils.

OTHER ESD FEATURES
- Cool cupboard in the kitchen
- Custom drawer for multiple recycling categories and composting in the kitchen
- Most of the furniture designed to be fully recyclable using reclaimed/recycled timbers and natural oil finishes.

LEGEND

① Bedroom
② Living
③ Dining
④ Kitchen
⑤ Bathroom
⑥ Laundry/toilet
⑦ Deck
⑧ Shade sails
⑨ Store
⑩ Entry

GROUND FLOOR PLAN



UPPER FLOOR PLAN