

Lateral thinking gives new life to an old house

The Plow House, by Melbourne-based sustainable design and build company Positive Footprints, demonstrates what can be achieved with existing housing, on a tight site with compromised solar access, by thinking outside the square.



- 1 The original rear of the house with fibro lean-tos that cut off interaction between the interior of the house and the backyard. Minimal windows at the rear also made the house's interiors dark and dark.
- 2 The renovation was designed to complement the form and history of the 1892 double-brick Queen Anne house, shown here from the street frontage. New Colorbond roofs are insulated with R3.5 Tontine batts, made from recycled PET bottles, with an R1.5 Bradford foil-backed blanket laid directly under the Colorbond.
- 3 Kitchen to the back garden. All lighting throughout is low wattage LED from The Environment Shop and energy-efficient ceiling fans are by Martec. Living area with polished Boral Envirocrete concrete floor
- 4 The upper level bathroom features a vanity unit made from old tallowood seats from the Melbourne Cricket Ground. A Greywater Diverter by Nylex diverts waste water from the shower, bath and basin to the garden.
- 5 Living area and kitchen beyond, showing polished concrete slab and recycled joinery timbers. Double glazed windows are fitted with an external electric venetian blind by Reflex Shade that can be turned to filter or direct light, or be retracted completely for total sun control.

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Photo 1 & 2 / Positive Footprints
Photo 3,4 & 5 / Rhiannon Slatter Photography

From the street, the 1892 double-brick Queen Anne house had withstood the test of time quietly and stoically. The house had originally been a display home for a long gone local brick factory, and the two front rooms had been lovingly renovated. However, the back was still a cramped, dysfunctional set of asbestos lean-tos that had been applied over the years, cutting off interaction with the rear yard. With the northern neighbour close to the boundary of the narrow site, and minimal windows at the rear, the house was dark and cold.

A new lease of life

The owners wished to give a new lease of life to the building through a renovation that would:

- Complement the form and history of the house
- Provide room to start a young family
- Provide light, warmth and connection with the rear garden
- Use the materials one of the owners had collected over the years in her duties as ranger with Melbourne Parks and Gardens

Choice of form and materials

The response was to choose a form and materials palette that would:

1. Provide operational performance, while minimising embodied energy and environmental impacts.

The only clear solar access available to provide the passive warming required was over the northern neighbour's roof. To harness this, a tall wall of windows and an inverted roof, the inverse of the existing pitch, was proposed. This response also provided for a roof deck, screened from overlooking issues, abutting onto a new bedroom suite hollowed out into the existing attic space. This use of the existing attic meant that the space requirements of the brief were achieved with minimal additional footprint, maximising the small backyard for the owners' gardening ambitions.

This strategy required high performance windows, good insulation, and high mass materials for optimal heat retention in winter, and cooling capacity in summer. The following materials were chosen for this function:

➤ Windows and glazing –

- Half the heat lost out of a well-insulated house goes out through the windows. So high performance windows were a must. Timber is a good choice thermally, but can have big impacts on habitat loss if sourced from native forests. The windows used were plantation hoop pine, while the glazed doors were recycled karri. Double glazing with a 14mm argon filled space and high solar heat gain low-e coating was used, in order to maximise heat gain and insulation. Finger-jointed timber frames also make use of timber off-cuts which would otherwise be chipped.
- As the window was tall and close to the boundary, an appropriately sized eave was impossible. The solution was to fit an external electric venetian blind. This can be turned to filter or direct light, or be retracted completely for total sun control.

➤ Existing external brick walls internalised –

- The extension also needed the capacity to store the warmth coming in through the new windows in winter. Rather than demolish, the existing brick walls were internalised to provide the required thermal storage and stabilise internal temperatures.
- The internal brickwork was cleaned down, but only moderately, with some fixings and paint lines left in place so that their history of supporting other structures could be seen. The now internal red bricks also provide texture and colour which give visual warmth (along with the timber work) to the grey of the concrete floor.

➤ Polished Envirocrete floor –

- Concrete was chosen as a material that would not only perform well as thermal mass, and lock to the stability of the earth below, but also be durable and highlight both the brick and the salvaged timber cabinetry. To counter the usually high embodied energy component of concrete Boral Envirocrete with 60 percent cement replacement with slag and fly ash was chosen. One hundred percent recycled aggregate was also used in the beams.
- The steel in the slab is 100 percent recycled from Smorgons ARC.

- The vapour barrier under the slab is 100 percent recycled from Plastic Technology.
- These measures save approximately five tonnes CO2 compared to a standard concrete slab.

➤ Walls and insulation –

- James Hardie 'Scyon Linea' weatherboard and Colorbond were chosen as durable and cost-effective lightweight claddings. Both are low in embodied energy per square metre, and Colorbond is readily recyclable at end of life. Colorbond comes pre-painted, and fibre cement weatherboards are more durable than timber equivalents, doubling the time between required paintings and thus halving the required maintenance over their life.
- R2.5 Tontine insulation made from recycled PET bottles was chosen as one of the highest R-rated products for the 90mm space of the plantation pine frame. Combined with a tape sealed reflective foil to the face of the studwork, this cost-effective insulation reuses a product from kerbside recycling.

➤ Roof and insulation –

- The 90mm wide rafters in existing roofs were battened out to provide the required space for R3.5 Tontine batts. All new roofs not only had the R3.5 batts between rafters, but also an airspace abutting the reflective foil underside of an R1.5 Bradford foil-backed blanket directly under the Colorbond roof. As well as providing high insulation values, the blanket directly under the tin has the dual benefit of stopping the drumming sound from rain, and catching any water condensing on the underside of the tin and directing it to the gutters. The glass wool in the blanket is made from 70 percent recycled glass.

2. Honour the existing building and incorporate salvaged materials gathered by the owners over the years

The client is a lover of nature. Through her profession as a park ranger she had salvaged many beautiful fallen timbers, which have now been reborn into many different facets of her home.

The kitchen overhead cabinets are made of recycled kauri from the old Albert Park Station platform (circa

1870). On the other wall, the kitchen shelving unit is made of Tasmanian blackwood and hoop pine, salvaged from the Royal Botanic Gardens. The kitchen drawers are made from a beautiful Golden Italian Poplar tree that once grew in the Royal Botanic Gardens and was planted in the 1870s.

Upstairs, the bathroom vanity bench once served many football enthusiasts as tallowood seats from the old Melbourne Cricket Ground stand. In the backyard, under a nectarine tree, beside the chicken run, and grey-water irrigated garden beds, children enjoy a game of hopscotch, made from mosaic tiles and handcrafted by the client using materials meticulously retained from leftovers at various Melbourne Flower Shows.

3. Provide a healthy environment for the young family to grow

The house follows the Asthma Foundation's guide for a healthy home. That is, a preference for hard surfaces, so that any dust can be seen and removed. Hydronic heating, though seldom required, heats the spaces without dusty air-conditioning ducts causing problems.

Air quality has also been enhanced by providing large opening doors and casement windows to pull in fresh air when the breezes are favourable. Low VOC paints, glues, grouts, and membranes have been used throughout to minimise potentially harmful off-gassing.

Hyperfloor polished concrete is VOC free, and the recycled spotted gum stairs and upper floor are oiled with organic low VOC Livos oil, rather than the usual polyurethane gloss. Rather than a patina of plastic gloss over the floors, they have the lustrous gleam and integrity of a material lovingly buffed.

Cabinetry throughout is solid timber with hand-rubbed tung oil. Where manufactured timber is used, as in the skirtings and architraves, E0 MDF substrate (low formaldehyde offgassing) has been specified.

With the bifold doors opening onto the recycled Ironbark deck and the garden beyond, interaction with the rear yard is now readily available. In this age of digital entertainment, there is no doubt that a design that encourages a family to get outside and be less sedentary is a very healthy thing.

Materials Selected

Building element	Product	Environmental justification
FOOTINGS		
Concrete slab*	Boral Envirocrete	60 percent cement replaced with fly ash 100 percent recycled aggregate to beams
Steel reinforcement*	Onesteel ARC	100 percent recycled steel mesh
Bar chairs*	Onesteel ARC steel mesh	Up to 50 percent recycled plastic mesh supports
Membrane*	Plastic technology 0.2mm builder's plastic	100 percent recycled plastic
BRICKWORK		
Bricks* Existing walls	Existing	Existing external brick walls internalised for thermal mass, cleaned and featured
Bricks*	Paddy's Bricks	100 percent recycled. New replacement where required and paving surrounds to house
Mortar to new bricks (and incidental concrete on site)*	Ecoblend by Independent Cement and Lime	30 percent cement replacement with fly ash
Lintels*	Onesteel	Part recycled content
Brick paving base*	Paving base by Alex Fraser Group	100% recycled masonry bedding to all sub-surface pipework
Mosaic paving tiles*	By owner	Broken tiles saved from Melbourne Flower Show, broken up and re-laid
CARPENTRY		
Framing	LaserFrame by Carter Holt Harvey	Plantation pine throughout (part FSC accredited) Beams and lintels in pine LVLs
Stairs*	Recycled spotted gum by Nullarbor Timber	Use of 100 percent recycled timber
Cladding 1	Weatherboard by James Hardie, Scyon Linea	James Hardie FC products are amongst the lowest embodied energy options available
Cladding 2	Colorbond corrugated	Low embodied energy (per m2), recyclable, pre-finished steel
Cabinetry	Various salvaged timber collected by the owner	
Timber fascia	Design Pine by Innovative Timber Products	LOSP treated pine, 40 percent FSC certified Finger jointed to use offcuts
Soffit lining	Hardiflex sheet by James Hardie	Low embodied energy material
Waterproof membrane and tile adhesive	Ardex	Low VOC (Volatile Organic Compounds) membrane and adhesive
Windows	Mouldright joinery by Hoop Pine Windows	Plantation LOSP treated. Finger jointed for stability and use of short lengths Glazing: 14mm argon filled double glazing with high solar heat gain, low emissivity coating
Window under flashing*	Damp proof course by Gem Plastics	100 percent recycled plastic
Doors*	Mouldright Joinery Recycled by Karri Glazed Doors	Karri is a durable and reasonably stable timber, 100 percent recycled
Door furniture	Corinthian	Non-cyanide plating technology, Australian made handles
Architraves, skirting and door jambs	Ultraprime by Carter Holt Harvey	Low VOC pre-primed E0 MDF
Fencing	Outdoor timber Tanalised E H3 pine	Contains no chromium or arsenic (uses copper, boron and organics)
Decking*	Red ironbark decking by Urban Salvage	Durable outdoor timber 100 percent recycled

Plaster*	Plasterboard by Boral Enviro	Two percent recycled gypsum and 100 percent recycled paper facing to stud walls
General construction adhesive	Maxbond Fast Grip by H.B. Fuller	Ultra low-VOC adhesive
Polished concrete	Hiperfloor concrete densifier by Husqvarna	Odourless VOC-free hardener, easy to clean and extremely durable
Upper flooring*	Recycled spotted gum by Nullarbor Timber	To match existing ground polished spotted gum floors, 100 percent recycled
Timber adhesive over joists	Ultraset SF by Bostik	Low-VOC off-gassing adhesive
Roof blanket*	Foil-backed blanket by CSR	R1.5, 70 percent recycled glass wool
Ceiling batts*	Thermal Batt by Tontine	R3.5, 85 percent recycled (from PET bottles) polyester batts
External walls*	SoundScreen wall batts by CSR	R2.5, up to 70 percent recycled
Gap filler around window and door jambs	Foamitt	Air seal and insulation around frames allows for movement
PAINTING		
Paints	EcoStyle paints by Rockcote	Ultralow-VOC paints. Free from APES, formaldehyde, glycol ethers, benzene or ammonia. Good Environmental Choice Australia (GECA) tick
Timber door finish	Ultradeck by Integrain	Low-VOC oil finish
Timber floor finish	Oil by Livos Australia	Organic ingredients, low-VOC penetrating oil
WATER		
Watertanks	9000 litre plastic tank by Teampoly	Manufactured from UV-stabilised food grade polyethylene
Roofing	Steel roofing by Colorbond	Cleaner surface for water collection over time, recyclable at end of life
Rainwater filters	H2O Tadpole Filters by Silvan	Two stage inline filters to each downpipe, no need for first flush devices
Pump and automatic mains backup	Pentair by Onga WaterSwitch	Automatic mains diversion when tank empty
Tapware	Flick mixer taps by Hansa	Single lever mixers with integrated water saving brake
Thermal valves	Water valves by EnviroSave	One to each fixture sends the 'cold' hot water in the line to the water tank
Toilet suites	Smartflush by Caroma	WELS four star 3/4.5 litre flush
Greywater diversion	Greywater Diverter by Nylex	One per bathroom, diverts waste water from showers, basins, and washing machine
Agricultural pipe*	Slotted pipe by Key Plastics	Recycled PVC piping
ENERGY		
Photovoltaics	1.5 kW grid connected	Saves 2.85t of CO2 per annum
Fans to living areas	'Precision 316' 1.4m ceiling fan by Martec	Super-efficient, propeller-like, 23 degree tapered fan blades
Heat shifting system	Easy Duct by IXL	40w ducted fan to move warm air from upstairs bedroom to older existing rooms
External venetian	External venetian by Reflex Shade	External electric venetian to large north-facing windows
Self-closing exhaust grills	Self-closing vents by Deflecto	Gravity louvres close when extraction fans not in use
Solar hot water	Evacuated tube solar by Apricus	Saves 1.5t of CO2 per annum, 315 litre stainless steel tank with instantaneous gas booster
Lighting	The Environment Shop	LED low wattage lighting throughout
* Denotes recycled content		