



1 The house in Melbourne's inner north was designed with a curved roof to minimise any overshadowing for Elizabeth and Rodney's neighbours to the south.



# Leading edge

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A 9-Star house in Melbourne raises the bar, environmentally and socially.

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## WHEN ELIZABETH WHEELER AND HER PARTNER RODNEY

Vlais set out to build a sustainable home in suburban Preston in Melbourne's north, their new house was always going to have that extra edge. From the outset theirs was an ambitious project aimed at high levels of sustainability, ultimately achieving a 9.1-Star energy efficiency rating. However, the couple also wanted to incorporate social ethics into the design of their home.

Concerned about the overshadowing their north-facing two-storey home would cause, they chose a distinctive curved roof which would allow their southern neighbours as much sun as possible. They also ensured their design would work well with the home their friends are planning for the block to the north, allowing for a communal garden and outdoor play space.

The 180 square metre house, designed by Positive Footprints, makes use of passive solar principles. Elongated on an east-west axis it has double glazed, low emissivity coated casement windows and eaves that allow for deep sunlight penetration in winter and shade in summer. Thermal mass is provided by a low embodied energy polished concrete floor and reverse brick veneer walls made of recycled bricks. Elizabeth explains that using recycled bricks was important because using virgin materials for thermal

mass often results in a net energy loss for the environment. Reverse brick veneer (RBV) is a construction technique in which the bricks are on the inside of the wall; in the case of Elizabeth and Rodney's home, the outside is insulated and variously clad with radially sawn timber, plantation pine plywood and corrugated steel. [Ed note: for more, see our article on RBV in *Sanctuary* 17.]

The design of the house also incorporates paths for cooling breezes. North- and south-facing windows are aligned to channel cool summer breezes through living areas, voids above the ground floor living room and bathroom allow air to move upwards and internal louvre windows also regulate circulation. The house is highly insulated and care was taken to ensure a draught-free building fabric.

The couple also installed a 3 kilowatt solar photovoltaic system and an evacuated tube solar hot water system with instantaneous gas boost. Two 2500 litre rainwater tanks are connected to the toilet and laundry. Rainwater is also used to water the garden, along with a greywater gravity diversion system that feeds water to the mini orchard. On the health front, zero volatile organic compound (VOC) paints and minimal off-gassing cabinetry and trims were used throughout.



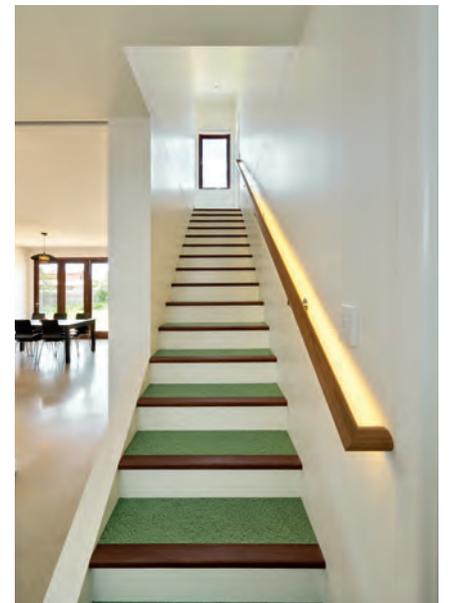
Image courtesy  
Positive Footprints

Material choice was also important for Elizabeth and Rodney. In addition to the recycled bricks, 60 per cent of the cement in the concrete slab is replaced with waste slag and flyash, and there is 85 per cent recycled PET bottle insulation in the roof. Concerned about unsustainable forestry practices, including monoculture plantations, the couple opted for a diverse range of timber – some recycled, and some from plantations and regrowth forests. They chose FSC certified timbers where these were available.

“We intended it as a house that fits our ethics and lifestyle, but we also wanted to show others that it is possible to achieve a liveable and sustainable home without spending a million dollars,” Elizabeth says. She admits they balked at some things because of cost – like a concrete floor for the second storey – but overall their drive was to include as many sustainable features as they could afford. In the end, the entire project, including the design and build, came to about \$420,000.

Since moving into the house in February 2011, the couple and their four-year-old son have had time to test its performance. Despite high thermal mass incorporated into the design, Elizabeth found living through a Melbourne winter without heating a little too much of a challenge and they plan to install a small split-system reverse cycle air conditioner. They also plan to add blinds to the double glazed floor to ceiling doors for added privacy and comfort.

Ultra low VOC marmoleum was used for the stair treads and the flooring in the upstairs playroom and studio. A sliding door between the stairwell and the living/dining area helps regulate thermal stratification.



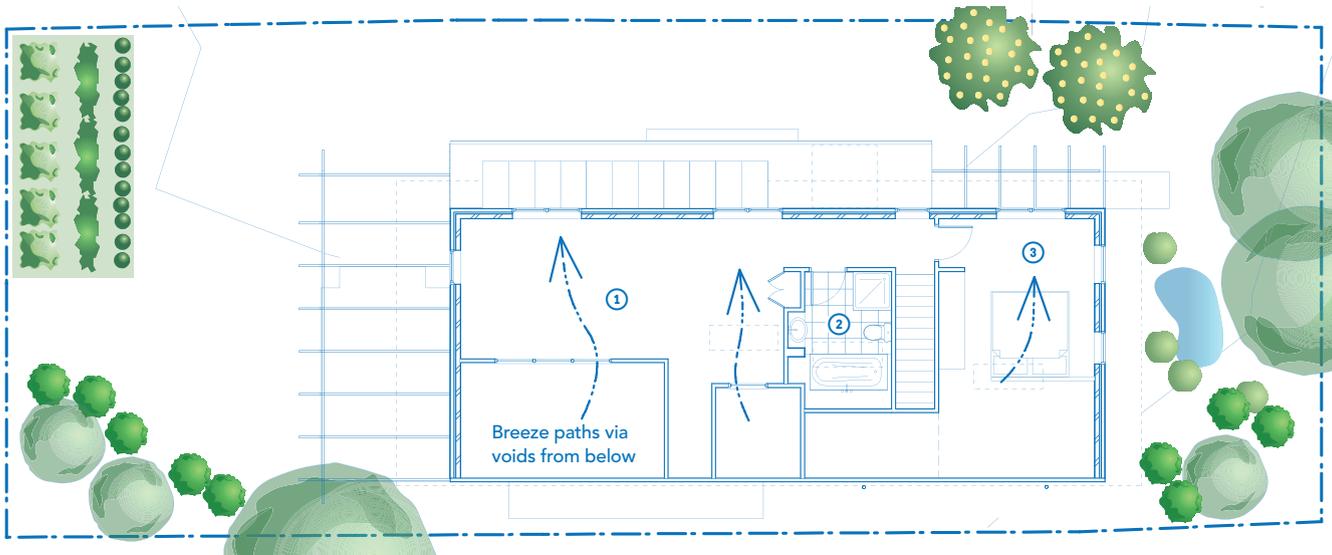
Low wattage LED and compact fluorescent lighting is used throughout the house. Ceiling fans cool in summer and circulate hot air down in winter. A pergola is planned to shade the western window and avoid too much solar gain in the living area.





GROUND FLOOR

- ① Deck (planned)
- ② Living
- ③ Kitchen
- ④ Dining
- ⑤ Bathroom/Laundry
- ⑥ Study/Playroom
- ⑦ Bedroom



UPPER FLOOR

- ① Studio/Playroom
- ② Bathroom
- ③ Bedroom

→ In the upstairs playroom and studio space, louvres opening into the voids above the laundry and living area can be adjusted to promote cooling ventilation in summer, or prevent thermal stratification in winter.



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A passive solar house requires its occupants to engage more thoughtfully with the environment than is necessary in a conventional home. Elizabeth explains that opening and closing so many windows and vents to bring cross breezes through, depending on the time of day and temperature, does take some getting used to.

So what elements have worked best? “The reverse brick veneer is pretty special,” she says. “Aside from thermal mass, passive solar performance and sound proofing, it gives the house solidity. And it contributes from an aesthetic point of view.”

Elizabeth is justifiably proud of all that has gone into making her house so pleasing from an environmental sustainability point of view. The couple’s overall project, however, will only be complete once the recently landscaped garden has had time to bloom and their friends who own the empty land next door build their home and move in.

Once that’s done, their plan is to have a shared backyard with chickens and veggies where children of both families can play. There will also be private courtyards between the two houses. Elizabeth believes sustainable homes can have positive social effects as well: “We wanted the house to have an impact in bringing about community. We’ve had an amazing level of interest in the house from people in our local area – people are always stopping for a look and a chat.”

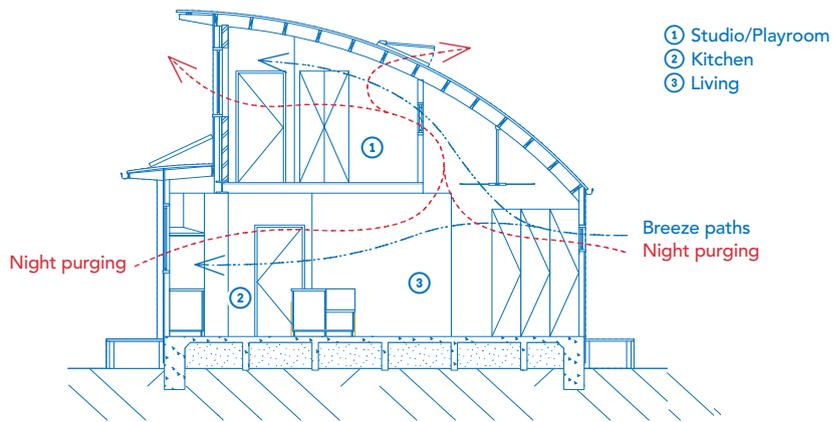


↑ The house’s orientation and layout bring sun deep within all living spaces. Louvred openings in internal walls aid the passage of cross breezes for ventilation and cooling.



↑  
A void in the downstairs bathroom – featuring a European-style laundry behind folding doors – has been designed as a drying area, with space for a hanging laundry rack. When in place, evaporatively cooled air passing over the rack can be drawn into the upstairs space. Greywater Divertas collect water from showers, basins, and the washing machine and disperse it to the garden watering system.

BREEZE PATHS THROUGH THE HOME



→  
A 3 kilowatt grid-connected photovoltaic system saves approximately 5.4 tonnes of CO<sub>2</sub> per year in the Melbourne climate.



←  
Sixty per cent of the cement component in the low embodied energy concrete slab is replaced with waste products slag and flyash. Windows in the northern and southern walls are aligned to channel summer breezes through living spaces for natural cooling and effective night purging.

# Preston residence

## —Specifications

### Credits

#### DESIGNER

Positive Footprints

[www.positivefootprints.com.au](http://www.positivefootprints.com.au)

#### PROJECT TYPE

New build

#### PROJECT LOCATION

Preston, VIC

#### COST

Approximately \$420,000

#### SIZE

House 180 sqm, land 350 sqm

#### BUILDING STAR RATING

9.1 Stars



↑  
Rainwater captured in two 2500 litre water tanks is used to flush toilets, for the cold water tap in the laundry and for garden watering.

### Sustainable Products

#### HOT WATER

– A Solar Lord evacuated tube solar hot water system with 315L stainless steel tank and instantaneous gas boost saves approximately 1.5 tonnes of CO<sub>2</sub> per year in Melbourne's climate  
[www.solarlord.com.au](http://www.solarlord.com.au)

#### WATER SAVING

– 2 x 2500L Team Poly plastic tanks to flush toilets, cold water tap in laundry and garden surface watering [www.teampoly.com.au](http://www.teampoly.com.au)  
– Porcher Heron WELS 4-star rated toilets flushed with rainwater  
– Redwater valves to divert first flow of “cold” hot water to tanks [www.redwater.net.au](http://www.redwater.net.au)  
– Silvan H2O Tadpole Primary Filter to each downpipe; Wet Frog secondary filter to tank [www.silvanh2o.com.au](http://www.silvanh2o.com.au)  
– Pentair Onga Waterswitch, coupled with pump and float switch [www.ongawaterswitch.com.au](http://www.ongawaterswitch.com.au)  
– Nylex Greywater Divertas collect from showers, basins and washing machine and disperse greywater via simple gravity diversion to subsurface garden watering system [www.nylex.com.au](http://www.nylex.com.au)

#### RENEWABLE ENERGY

– A 3kW grid-connected photovoltaic system from Enviroshop saves approximately 5.4 tonnes of CO<sub>2</sub> per year in the Melbourne climate  
[www.enviroshop.com.au](http://www.enviroshop.com.au)

#### PASSIVE HEATING & COOLING

– House orientation and layout bring sun deep within all living spaces  
– Breeze paths: windows to north and south of rooms are aligned to channel summer sea breezes through living spaces for natural cooling and effective night purging  
– Pergola and eaves over north-facing windows provide shade from summer sun and let in winter sun

– A western pergola is planned, with deciduous vines for summer shade  
– A void in the laundry has been designed as a drying area; a hanging drying rack provides evaporative cooling  
– Reverse (recycled) brick veneer to upper walls, combined with effective night purging strategies, to counter natural heat build-up in summer while maximising heat gain in winter via thermal lag and stabilising internal temperatures. Recycled brick provides thermal mass to reduce operational energy without a big compromise in embodied energy from virgin stock.  
– Internal louvre windows and a stairwell door regulate thermal stratification

#### ACTIVE HEATING & COOLING

– Reversible Martec Precision ceiling fans to cool in summer and circulate hot air down in winter  
[www.martecceilingfans.com.au](http://www.martecceilingfans.com.au)

#### BUILDING MATERIALS

– Boral Envirocrete low embodied energy concrete: 60 per cent of cement is replaced with waste products slag and flyash; 100 per cent recycled aggregate; Smorgon's ARC 100 per cent recycled steel reinforcement; 100 per cent recycled plastic membrane. This saves approximately five tonnes of CO<sub>2</sub> compared to a standard slab of this size [www.boral.com.au](http://www.boral.com.au)  
– Foamex Diamond Pods waffle slab includes 40 per cent recycled content [www.foamex.com.au](http://www.foamex.com.au)  
– Boral Enviro Plasterboard  
– Stairs: Alpine FSC E0 MDF with recycled timber nosings, Forbo “Herb Garden” Marmoleum treads and zero VOC painted risers  
[www.alpinemdf.com.au](http://www.alpinemdf.com.au),  
[www.forbo-flooring.com.au](http://www.forbo-flooring.com.au)  
– Alpine FSC E0 MDF cabinetry and trims throughout

– Ramps and decks are made from 90 per cent recycled and reclaimed content and low maintenance decking over ACQ (non-arsenic) treated pine [www.modwood.com.au](http://www.modwood.com.au)  
– Pergola posts: Timber milled from fallen Cypress Macrocarpa windbreaks in Gippsland  
– Floor Gres Ecotech tiles with recycled content on low VOC adhesive bed [www.floorgres.it](http://www.floorgres.it)  
– Cladding materials: radially sawn timber, rough sawn vertical battens over Carter Holt Harvey Ecoply and Colorbond  
[www.chhwoodproducts.com.au](http://www.chhwoodproducts.com.au),  
[www.colorbond.com](http://www.colorbond.com)  
– Recycled red bricks from Paddy's Bricks [www.paddysbricks.com.au](http://www.paddysbricks.com.au)  
– Mortar: Independent Cement & Lime Ecoblend with 30 per cent cement replacement with industrial waste products slag and flyash  
[www.independentcement.com.au](http://www.independentcement.com.au)  
– Gem Plastics damp proof course: 100 per cent recycled plastic  
[www.gemplastics.com.au](http://www.gemplastics.com.au)  
– Colorbond steel roofing

#### INSULATION

– Ceiling: Bradford Anticon foil backed blanket (R1.5, 70 per cent recycled glass wool) and Tontine Thermal Batts (R3.5, 85 per cent recycled polyester)  
[www.bradfordinsulation.com.au](http://www.bradfordinsulation.com.au),  
[www.tontineinsulation.com.au](http://www.tontineinsulation.com.au)  
– External walls and walls between service and living areas: Bradford Enviroseal reflective foil and Tontine Thermal and Sound Batts (R2.5, 85 per cent recycled polyester batts). “This is one of the few products that provides an R2.5 rating within a standard 90mm cavity space,” says designer and builder Jeremy.

# Preston residence

## —Specifications

### Sustainable Products

#### WINDOWS & GLAZING

- Double-glazed, low-emissivity coated, argon-filled casements and bi-folds maximise ventilation and scoop in local breezes
- Plantation hoop pine timber window frames and recycled Karri door frames, LOSP (non-arsenic) treated. Sourced from Mouldright Joinery [www.mouldright.com.au](http://www.mouldright.com.au)

#### LIGHTING

- Low wattage LED and compact fluorescent lighting throughout

#### PAINTS, FINISHES & FLOOR COVERINGS

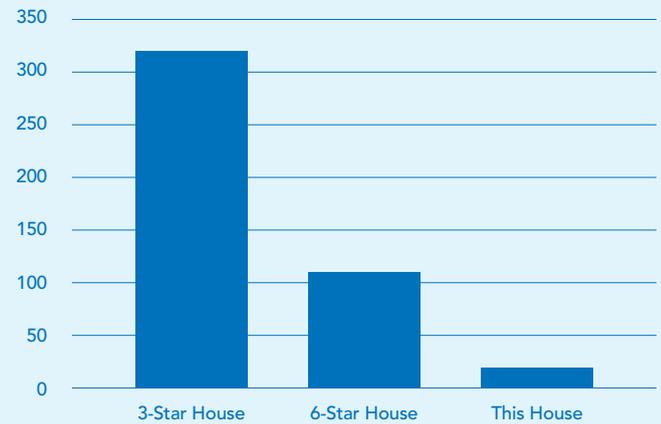
- Bedrooms: Velieris Willaura undyed, low VOC wool carpet and Bridgestone Airstep low VOC underlay with 85 per cent post consumer recycled textile content [www.velieris.com](http://www.velieris.com), [www.airstep.com.au](http://www.airstep.com.au)

- Ultra low VOC GECA-accredited Forbo Marmoleum Global 3 flooring, made from natural components including linseed oil, pine wood flour and rosin, limestone, woven jute backing [www.forbo-flooring.com.au](http://www.forbo-flooring.com.au)
- Oikos natural paints and stains to interior and exterior: ultra low VOC with GECA accreditation [www.designerpaintco.com](http://www.designerpaintco.com)

#### OTHER ESD FEATURES

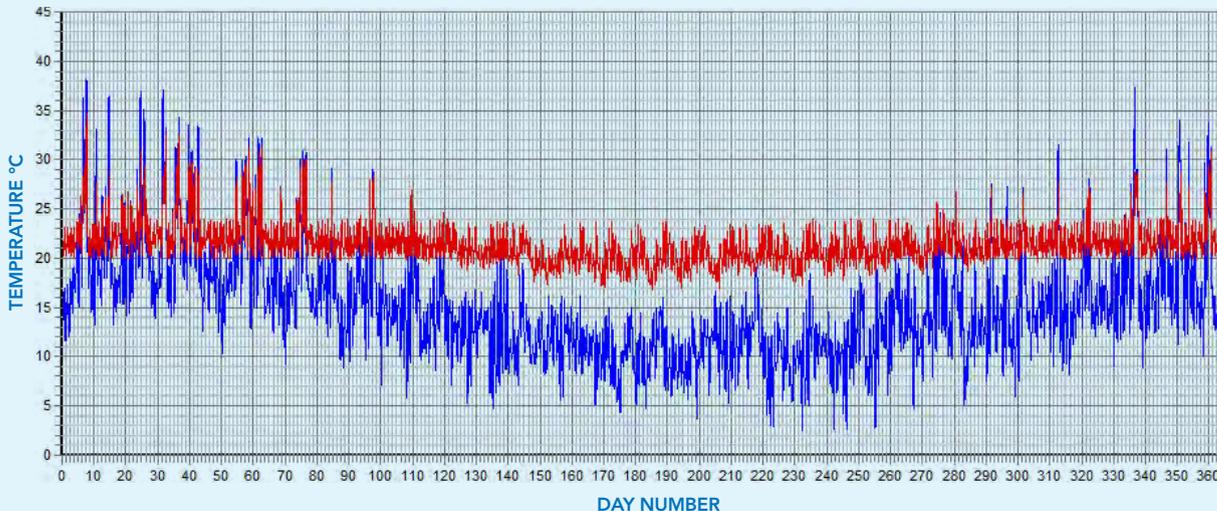
- Deflect-o self closing louvred wall and under-eave vents: gravity louvres close when extraction fans are not in use, to stop unwanted drafts and heat loss through ducting from rangehood and bathroom exhaust fans [www.deflecto.com](http://www.deflecto.com)
- Food forest: vegetable and permaculture garden being established that will be watered by tank water and greywater. A chicken run has also been established [www.permablitz.net](http://www.permablitz.net)

#### AVERAGE ANNUAL HOUSE ENERGY USAGE (MJ/m<sup>2</sup>)



ⓘ Designer Jeremy's modelling predicted a significantly reduced energy usage for this home compared with a typical 3-Star or even 6-Star house.

#### TEMPERATURE PROFILES OVER ONE YEAR FROM 1 JANUARY



ⓘ Using AccuRate building rating software, Jeremy was able to predict the temperature profile in the kitchen and living area (in red) compared with typical outside temperatures (in blue) across a calendar year, with no active heating and cooling.