High achiever

The latest project by Positive Footprints is the first in a series of off-the-plan 9 Star homes and an attempt to bring sustainability to the mainstream.

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Windows to north and south of rooms are aligned to channel prevailing summer breezes through living spaces for natural cooling and effective night purging. Casement windows with flyscreens scoop breezes inside to cool the house at night. When the night is still, automatic hopper clerestory windows open to release hot air.

JEREMY SPENCER AND CHI LU OF Positive Footprints have found an approach that works – meticulous planning, building, and then living in their projects to experience a home's performance firsthand. Their latest, in Melbourne's bayside suburb of Seaholme, where they live with their two primary school-aged children and Jeremy's ageing parents, represents the culmination of over 10 years' practice in sustainable building and design.

The project is one of four 9 Star designs, which aim to make the commercial case for energy-efficient, affordable homes (this one is the most expensive in the series at $495,000, the cheapest $350,000). "We wanted to make it easier for people to have a beautifully designed sustainable home which doesn't cost a million dollars," says Chi.

They have called this smart system-automated home Solar Sollew – a playful take on Dr Seuss's mythical city Solla Sollew – 'where they never have troubles, at least, very few'. The four designs allow for various orientations, with window location, shape and structure of the building varying to optimise passive solar design. All designs integrate indoor and outdoor spaces and focus on enabling sustainable living. "One of the reasons we went down this path (to design and build sustainable homes) was the realisation that often people try to live →

All appliances are highly energy-efficient, something Jeremy recommends all clients reserve some budget for. "From an environmental point of view it's a more effective way to spend your money. It's not worth going for that extra star for all the expense if the carbon you emit in the house and your whole lifestyle negates that."

sustainably but their house actually stops them," Jeremy says.

The home's low carbon output (it was carbon positive by 2.3 tonnes after the first four months) is aided by its highly energy-efficient appliances, for which Jeremy recommends all his clients reserve some budget. "From an environmental point of view it's a more effective way to spend your money," he says. "It's not worth going for that extra star for all the expense if the carbon you emit in the house and your whole lifestyle negates that."

Accessibility features are also designed in to suit a range of occupants over the home's lifespan. There are lower than normal benchtops, wide doors, ramps & stepless thresholds and a disabled bathroom downstairs, while walls upstairs are solid blocked internally for the easy addition of grab rails if required. Catering for Jeremy's father, who is in a wheelchair, made such considerations necessary, but designing for multiple users and co-generational living is a natural fit with Jeremy and Chi's values and is now incorporated into all of their designs.

But perhaps the stand-out feature of the home is its integrated intelligence. The Building Control Management System (BCMS) monitors wind speed and temperatures; a generous awning above the north-facing rear windows closes to prevent damage if the wind is too strong, and clerestory windows open if it is cooler outside and too warm inside (above 24 degrees). The system also regulates the greywater irrigation system and the earth tube cooling, an experiment in dealing with extreme heat, bringing in cool air from the stable 17 to 18 degree summer earth when the house reaches 24 and it is hotter outside.

Predictions of more frequent extended high summer temperatures also influenced the use of phase change materials (PCM) upstairs. Uninterrupted flow from the wide windows of the skillion roof at the back of

the upper level to the deck and windows at the front allows the PCM to cool down and reset in the evenings with sea breezes. Breezes are also channelled across the bright and spacious open-plan living areas on the ground floor, with bifold doors overlooking the productive garden.

The carefully planned garden is landscaped with recycled concrete pavers, reclaimed railway sleepers, native grasses for the lawns and indigenous and edible plants for ground cover (300 strawberry plants). Plants are either chosen to benefit native microfauna, including several endangered butterflies found in the area, or are edible to help cut down on food miles. There are about 30 fruit trees watered from an underground greywater system, fed by water from the bathroom and laundry. A small greenhouse constructed with leftover materials from the build has a wide range of functions, including seed growing, a place to dry clothes in the rain and, eventually, a home for chickens. →

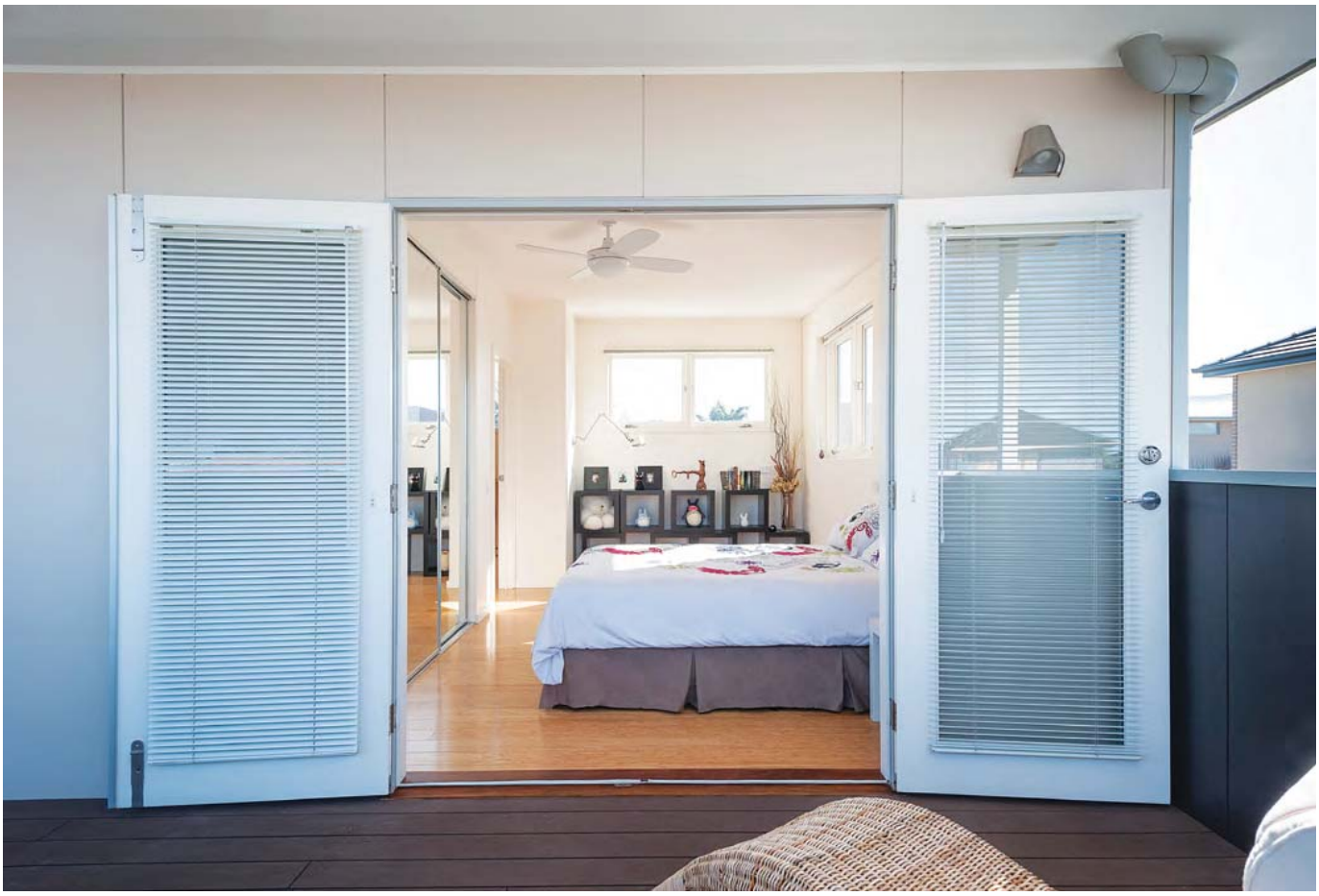
There are 30 fruit trees watered from an underground greywater system fed by the bathroom and laundry, which also works to cool the earth tubes. 'Worm juice' supplements the plants' growth.

The north-facing productive garden uses recycled concrete pavers, reclaimed railway sleepers, native grasses for the lawns and indigenous and edible plants for ground covers (300 strawberry plants). A 7000L Colorbond rainwater tank collects water from the roof. There is also a solar power-lit shower in the garden for return trips from the nearby beach.

PCMS AS LIGHTWEIGHT THERMAL MASS

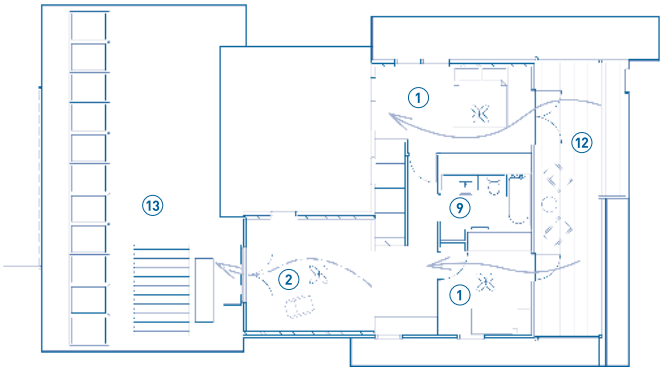
BioPCM 25-degree phase change blanket was used as a lightweight alternative to thermal mass in the upper level where there was no structural support for traditional thermal mass, to help keep it cool in summer. The blanket's cells, installed directly behind the plasterboard and on the inside of the insulation, are filled with vegetable-based compound that melts (or changes phase) between 25 and 27 degrees. This melting uses a lot of thermal energy, thus limiting the temperature rise in the room until the compound in all the cells is melted. Expected peak heating loads were calculated and enough of the blanket was added to ensure it wouldn't be exhausted on any one day before the sun goes down, maintaining a maximum high temperature of 27 degrees. A floor plan that facilitates effective night purging ventilation allows the product to cool and reset on all but the hottest summer nights, ready for the next day.

While traditional mass is still favoured, as it works over all temperature bands, Jeremy recommends people ask their energy rater to provide details on the peak heating and cooling loads for each room if installing PCM to ensure it is at the correct level. [Ed note: for more information on phase change material see *Sanctuary* 21]

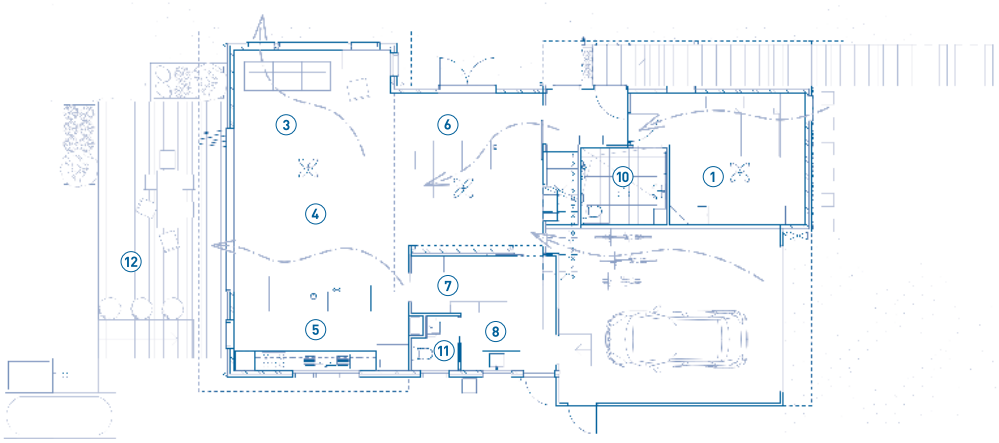


Wide openings north and south of rooms channel prevailing summer breezes through living spaces for natural cooling and effective night purging.

FIRST FLOOR PLAN



GROUND FLOOR PLAN



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LEGEND

1. Bedroom
2. Bedroom/Study
3. Lounge
4. Dining
5. Kitchen
6. Living
7. Pantry
8. Laundry
9. Bathroom
10. Ensuite
11. Toilet
12. Deck
13. Roof with solar and solar hot water

COOLING FROM THE EARTH

Jeremy installed earth tube cooling for the first time in this project as an experiment in maintaining comfortable indoor temperatures in summer. This consists of a ground loop of 150mm PVC approximately 30m in length, buried at between 2.5 to 3 metres beneath the ground, where the soil is generally around 17 to 18 degrees in summer. When the house reaches over 24 degrees and it is hotter outside, the system is activated by the BCMS, drawing the earth's cooler air through the pipes and back into the house at three points – the couch in the living area, above the dining table, and to the upstairs rumpus.

The pipes are helped to keep cool by the greywater lines that run above the trench, which moistens the soil and aids heat dispersion. Fruit trees planted above also take advantage of this moisture.

The system uses three 50-watt fans to transfer the air (as opposed to 2-3kW of power used by a typical heat pump air-conditioner).

Solar Sollew

—Specifications

Credits

DESIGN & BUILD
Positive Footprints

PROJECT TYPE
New build

PROJECT LOCATION
Seaholme, VIC

COST
$495,000 (incl. prof. fees)

SIZE
House 220 sqm (incl. garage),
Deck & balcony 50 sqm
Land 630 sqm

BUILDING STAR RATING
9 Stars

Sustainable Features

HOT WATER
– Solar Rinnai Excelsior Thermosiphon system with stainless steel tank.

RENEWABLE ENERGY
– 3kW grid-connected polycrystalline Amerisolar panels with SMA inverter
– Tailor-made MacTech Home Automation Building Management Control System.

WATER SAVING
– A Nylex Greywater Diverter collects from upper bathroom and washing machine
– 7000L Colorbond rainwater tank
– Tank-fed outdoor shower for after-beach use.

PASSIVE DESIGN
– Windows to north and south of rooms aligned to channel prevailing summer breezes through living spaces
– Casement windows with flyscreens scoop breezes inside to cool the house at night. When the night is still, automatic hopper clerestory windows open to release hot air
– Thermal mass in the slab, reverse brick veneer walls and PCM help moderate temperature.

BUILDING MATERIALS
– Caesarstone benchtop with engineered quartz stone, 95% natural stone, 5% resin
– LETO bamboo board lines wall and under stair shelves, stair treads and risers
– Mosowood prefinished bamboo click floorboards
– Recycled red bricks from Paddy's Bricks
– Mortar (and incidental concrete onsite) from Independent Cement & Lime's Ecoblend, 30% cement replacement with industrial waste products slag and flyash
– Boral Envirocrete, 60% cement replaced with slag & flyash
– Husqvarna HiPERFLOOR concrete densifier, odourless and VOC-free
– Gem Plastics damp-proof course, 100% recycled plastic
– D&R Henderson Orange Tongue particleboard flooring (75% pre-consumer recycled content)
– Recycled telephone pole used for stairwell balustrade with Novofibre strawboard Infill panels from wheat straw waste, with EO low-VOC adhesive
– Ekodeck composite decking by Ekologix
– James Hardie Easylap cladding
– Colorbond corrugated cladding.

Insulation and phase change materials
– CSR foil-backed R1.5 blanket in roof (70% recycled glass wool)
– R6.0 Fletcher Pink Batts in ceiling (up to 70% recycled glass, low-VOC)
– R2.7 Fletcher Sonobatts (up to 70% recycled glass, low-VOC) in external walls, utility and bathroom
– CSR Enviroseal reflective foil to external walls
– Sika Boom expanding foam seals to cavity between the window/door and adjacent framing
– BioPCM 25 degree phase change blankets on upper level.

ACTIVE HEATING & COOLING
– Martec Lifestyle 56" 23 degree fan blades
– Earth tube cooling system [see p19 for details].

WINDOWS & GLAZING
– Mouldright plantation hoop pine windows with low-toxicity treatment
– Double-glazed, argon filled, low-e windows throughout.

LIGHTING
– Velux roof window skylight
– Solatube skylight
– LED globes from ES Consulting Services.

PAINTS, FINISHES AND FLOOR COVERINGS
– Cabinetry made with E0 MDF throughout
– Eveneer FSC timber veneer by Elton Group finishes kitchen cabinetry
– Ecolour zero-VOC paint throughout
– Low-VOC Bostik Ultraset SF flooring adhesive
– Alpine FSC E0 MDF low-formaldehyde glue.

OTHER ESD FEATURES
– All appliances highly energy-efficient
– Green switches used to cut down standby loads
– Productive garden to minimise food miles
– Raised Ecowood vegie bed close to kitchen for ease
– Excavated topsoil from slab used rather than removed off-site.