Kangaroo Island SA

NEW HOME

ZONE 6: Mild temperate

Topics covered	
Rainwater harvesting	
Wastewater treatment	
Reducing Embodied Energy	
Greenhouse gas reductions	
Sustainable materials use	
AccuRate (thermal comfort)	5.8 (full rating)

Designed for an older couple and their active, close family, this house demonstrates a straightforward, effective application of passive design principles for a house in a beautiful, but demanding, location. Its use of thermal mass has been integrated and expressed in the design as a effective aesthetic feature wall that also tells a story about the family's interests.

DESIGN BACKGROUND

The clients comprise an extended family of grandparents, their children and grand-children. The whole family were involved in the decision to secure the land, eliminate farming activities and deal with the consequences of trying to repair a degraded landscape.

With the goal of rehabilitating the land back to something like the original stable ecosystem it was clear that there would be a good deal of work to do to that would include addressing problems of soil erosion and weed control. In order to do this and to create a springboard for wider involvement, the choice was made to place a sustainable home on the property.

The older generation in the family have worked in international education up to UNESCO Pacific region level and continue today to provide elective programs in sustainability to Japanese university student groups. Their idea was to create a retirement home that was also accessible and able to offer cross-generational ownership to other family generations, and to give access to visitors as a 'show and tell' educational destination.

LOCATION AND CLIMATE

The property faces the northern coast on Kangaroo Island's 'neck', formed by the bay and Pelican Lagoon.

The land has been farmed since European settlement. As a result most of the indigenous vegetation has been replaced by grazing grasses.

The site is subject to the sea influence from both north and south coasts, particularly winds and salt spray.

STRATEGY

Plan and orientation

The relatively modest plan provides for the grandparents' personal spaces including a library, adjacent to the main entry, with a central shared living area and kitchen. The west wing of the house has two spaces for visitors and the rest of the family.

The building was placed to provide:

> Good solar orientation to the north.

> Land and sea views – also to the north.

> Earth sheltering, with a berm into the rising ground on the south side of the building.

The earth sheltering design strategy not only contributes to passive design goals but it also minimises the visibility of the building from outside the site, notably from the nearby viewing area on Prospect Hill/Mount Thisby.

Shell fabric

The insulated roof, ceiling and walls are set within an 'exoskeleton' portal frame system that sets most of the main columns outside the walls. This avoids thermal bridging from large steel members crossing the wall thicknesses and provides a strong architectural theme.

The construction system permitted the roof to be erected and construction to continue beneath irrespective of weather conditions.

Thermal mass and insulation

The project has good thermal mass and earth linkage with the concrete floor and limestone rear wall. The earth coupling of the berm construction against the south wall assists with maintaining stable temperatures and comfort conditions.

The 'Pale Eucalypt' corrugated steel roof is insulated with R2 batts, an air gap and reflective foil sisalation. Where there is a lower ceiling it is also insulated and insulation extends into the deep overhangs (which form narrow verandahs), helping to reduce heat transmission in summer. The walls of the main framed structure are clad with 'Gull Grey' horizontal corrugated steel sheets with R2 insulation batts and sisalation and have plasterboard linings.

Ventilation

Cross ventilation to the main living spaces is extremely good with the air able to flow 'passively' from the cool side windows set with their sills at the height of the earth berm, to the high clerestorey openable windows. A narrow but wide pantry is set into the earth berm wall to maximise the effect of 'coolth' with a ventilation tube and induction vent that cools incoming air.

Offset ceiling fans (not set centrally over the space) are used to bring warm air down to the floor in winter, and to accelerate cross-ventilation in summer.

Windows and glazing

The clerestory windows are set to let in the winter sunlight to the main central area where it strikes the tiled floor. The eaves and the verandah formed by the 'exoskeleton' portal frames provide summer shading.

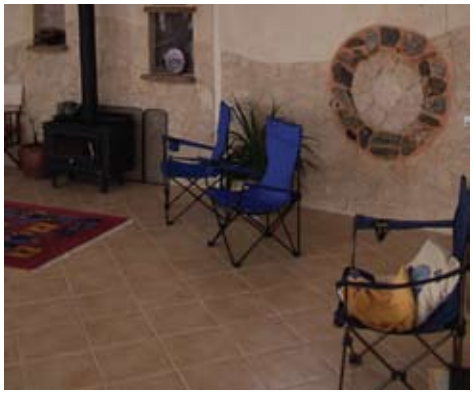
Materials and waste management

The corridor in both the stone and plywood walls is shaped to provide privacy from the front door and then continue the geological 'story' being told along the full length of the building. A curved front wall visually ties the entry of the building to the horizontally corrugated rainwater tanks. Other curved elements include the entry masonry port hole.

Waste control included ordering materials pre-cut to size and fitted on-site, with waste returned to the mainland.

Lighting and daylighting

Daylight in the house is pervasive. Artificial lighting includes high efficiency LED lighting on trapeze wires – set below the fans to avoid 'strobing'.



Floorings and finishes

Family ownership is expressed in the detail of the limestone wall, with a wave form between the faced limestone and upper levels of render, displaying the son's geological rock samples from around the planet.

Rainwater

The house has 80,000L rainwater tank capacity to store captured roof water. Water efficient fixtures were selected to minimise consumption.

Water heating, energy and appliances

Heating is by slow combustion wood stove. Appliances run from bottled gas. Kitchen appliances have been selected for their energy efficiency. Hot water is provided by a close-coupled solar system.

The house is powered from a 1.3kW photovoltaic array on the roof of the nearby garage that also houses a 1100ah 48V battery bank and a 2kW inverter with remote in-house read out.

Landscaping and site impact

The site is relatively exposed and denuded. It now provides a secure base for the family to continue land revegetation activities and bring in student groups for study stays at the property.

EVALUATION

The reported experience from the occupants is that comfort is maintained passively with some supplementary heating from the stove, and that energy use is within the capability of the stand alone photovoltaic system (5.8kWhr/day on average).

The architect's assessment placed the building in the 'close to carbon neutral' category, well above South Australia's minimum 5 Star compliance (which is assessed as equivalent to requiring 21kWhr/day in this climate zone).

PROJECT DETAILS	
Architect:	Emilis Prelgauskas
Engineer:	Lindsay Ames
Builder:	Owner Builder

Principal author:
Paul Downton