Canberra ACT

NEW HOME

ZONE 7: Cool temperate

Topics covered
Passive design
Rain water
Embodied energy
Greenhouse gas reduction
Indoor air quality
Sustainable materials
Renewable energy production
Bio-septic treatment
Autonomous from electricity grid
Active solar shading devices
Solar hot water

AccuRate (thermal comfort)	6.8 (regulatory)

The brief for this house was for a building with the highest possible environmental credentials. It is of mud brick and recycled timber construction, is independent of the electricity grid, and is powered by a large photovoltaic system.

DESIGN BRIEF

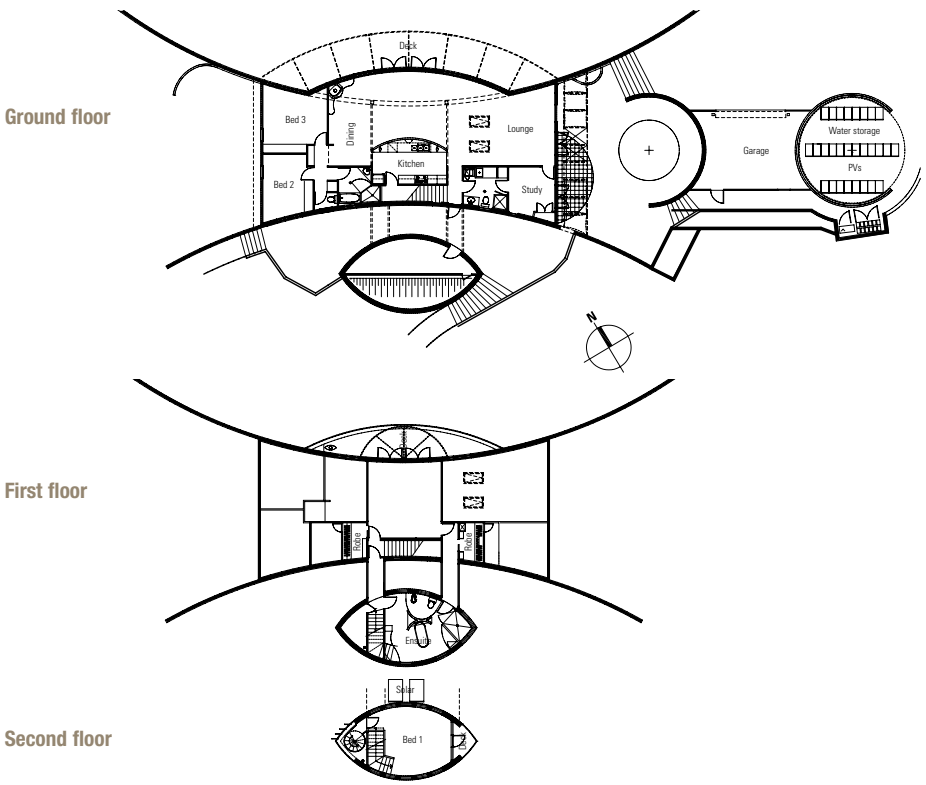
The clients' brief was to produce a thoroughly environmental building. The architects adopted virtually every strategy possible to create an exemplary environmental building. Last year TT Architecture won a national environmental building award for the visitors centre at Tidbinbilla nature reserve in the ACT. This building is a natural progression of the trend set in the Tidbinbilla project towards autonomous buildings.

The building is a fine example of environmental house design, and is well suited and appropriate for the region.

THE SITE

The site is in a rural location 30km west of Canberra (ACT), at a higher altitude than most of Canberra and right on the border of NSW. The site was selected to give maximum views of the Canberra district, to enable a house on the site to respond to the local topography and to maximise winter solar gain within the house.

[See: 2.2 Choosing a Site]



THE CLIMATE

The local climate is classified as cool temperate and the main characteristics of this climate are:

> low humidity.

> high diurnal range.

> four distinct seasons.

> summer and winter conditions exceeding human comfort range.

> cold to very cold winters.

> rainfall shared fairly evenly through all months of the year.

> hot, dry summers.

> variable spring and autumn conditions.

> cold winter and hot summer winds from the north-west.

> cool summer breezes from the south-east.

[See: 4.2 Design for Climate]

DESIGN AND BUILDING FORM

The house is designed with very high levels of thermal mass, good orientation and excellent insulation. The thermal mass takes the form of concrete floor slabs and internal masonry construction.

The following is a list of some of the issues that were taken into account during the design and construction of the dwelling.

MATERIALS

The house is constructed from locally manufactured mud bricks and recycled timber. The form of the building, with curved earthen coloured external walls, is intended to give the impression of a structure that rises directly out of the ground. The selection of materials brings together the overall environmental theme of the project.

The Scully home is a comprehensive attempt to create an environmental exemplar of a national standard. [See: 5.0 Material Use]

INSULATION

Styrofoam boards have been used at the edge of the slab and under the perimeter of the slab to minimise the losses in this area.

Polyester batts have been used in the ceiling as insulation.

The external cavities have been filled with rockwool insulation to improve their thermal performance. The rockwool is a benign substance and it should be noted that the cavities have been made wider than standard (at 100mm) to allow for a higher level of insulation. [See: 4.7 Insulation]

THERMAL MASS

The house is generally of high thermal mass construction. It has external double masonry walls, and the internal skin uses rendered clay bricks. The clay bricks add significantly to the total available thermal mass inside the skin of insulation. The building is built on a concrete slab. This high thermal mass construction is the most appropriate design response for the local climate which experiences high diurnal range. [See: 4.9 Thermal Mass]

WINDOWS

The windows have an external frame of aluminium and a timber frame and reveal internally. These windows provide a low maintenance solution to weathering yet have a significantly higher 'R' rating than aluminium–only frames. The windows are all double-glazed and perform as well or better than timber double-glazed equivalents. [See: 4.10 Glazing]

MATERIALS

Recycled materials

Significant effort has been made to source recycled materials for this building.

> **External cladding** is fabricated from recycled brushbox from the Walsh Bay wharf in Sydney.

> **Joinery** throughout the house has been made from either hoop pine from plantations in Queensland or blackbutt recycled from the Kingston foreshores site in Canberra.

> **Lintels** are made from ironbark, sourced from the old Pyrmont Flourmill in Sydney. Some of these lintels and massive structural posts are up to 100 years old.

> **Flooring** in the kitchen and the stairs is made from red mahogany, a rare timber native to the coastal forests of south-eastern Australia. It is now only available as recycled timber. The remaining floors are made from blackbutt, which grows in the same area as the red mahogany. The red mahogany was recycled from government workshops that were demolished at the Kingston foreshores site, and the blackbutt came from the old Pyrmont flourmill. The flooring is laid on the concrete slab. [See: 5.3 Waste Minimisation]

Mud bricks

The external walls of this house are constructed of mud bricks made locally. The bricks were strengthened by the addition of cement to the mix, and were strength-tested by the CSIRO. The bricks were all made by hand at the Old Canberra Brickworks and transported to site. Rather than being laid as puddle blocks in the traditional manner these blocks are used as the external skin in a cavity construction.

Paint

Natural organic paint has been used in this project that does not give off potentially hazardous vapours. The vapour from normal paint contains numerous toxic chemicals including pigments, solvents, dryers and fillers.

Reconstituted wood products

No reconstituted wood products (such as particleboard) were used in the house. The binding agents used in these products produce and release formaldehyde gas as they cure, a process which can take up to three months. Formaldehyde is an unpleasant smelling irritant and possible human carcinogen. The lengthy curing period means that both contractors and occupants are exposed to the gas.

GREYWATER AND SEWAGE TREATMENT

The house uses a novel approach to sewage treatment. A Bio-septic system takes the sewage product of the house, and after macerating it, sends it to a tank containing a reed-bed system. This tank uses the sewage as a natural nutrient source for the reed-bed. The effluent from the bio-septic tank is filtered with sand and ultra-violet light and produces water of a suitable quality to use in gardening. In fact this water comes out so clean that both the clients and the architect have drunk it.
[See: 7.4 Wastewater Re-use]

POWER

Power connection

The house has no connection to mains power. Power is drawn from an array of 28 photovoltaic panels mounted on top of the stormwater tank. These feed into a sub-system of 24 large batteries and inverter housed in a custom designed store. The complete system produces approximately 13 kilowatts of power using BP Solarex monocrystalline solar modules, and includes an 8.5KVa gas generator as a backup. The system is fully automatic. [See: 6.7 Photovoltaic Systems]

Solar hot water system

Two solar hot water panels mounted on the rear tower provide the hot water for the house.
[See: 6.7 Solar Hot Water]

OTHER FEATURES

Adjustable shade structures

The house incorporates adjustable shade structures to the north. This enables the house to be suitably shaded in the summer. With the removal of the structures in winter the winter solar gain is improved. [See: 4.4 Shading]

Water efficiency

The landscape plan has been devised with low water use in mind. The large 20,000L water tank makes the house self-sufficient for water needs. [See: 2.4 Sustainable Landscapes; 7.3 Rainwater]

Lighting and appliances

Wherever possible (lights, fridge etc) low energy appliances and fittings have been used, with little or no sacrifice in comfort or convenience.
[See: 6.3 Lighting; 6.4 Appliances]

Heating

Despite the fact that the high energy rating of the house will make it largely self-heating, a heating system has been installed. This system relies on reticulated hot water feeding into radiant panels mounted throughout the house. When necessary this system will operate on overcast winter days. It will be run on bottled gas powering a high efficiency hot water tank.
[See: 6.2 Heating and Cooling]

Building process

The building process has revealed many areas of technical difficulty and innovative construction. Dowse Building has shown much ingenuity in solving the constructional issues as they arose and have always been on hand to offer positive advice to the clients and the architects.

PROJECT DETAILS	
Architect:	Tony Trobe, TT Architecture
Builder:	Ron Dowse, Dowse Constructions

Principal author:
Geoff Milne