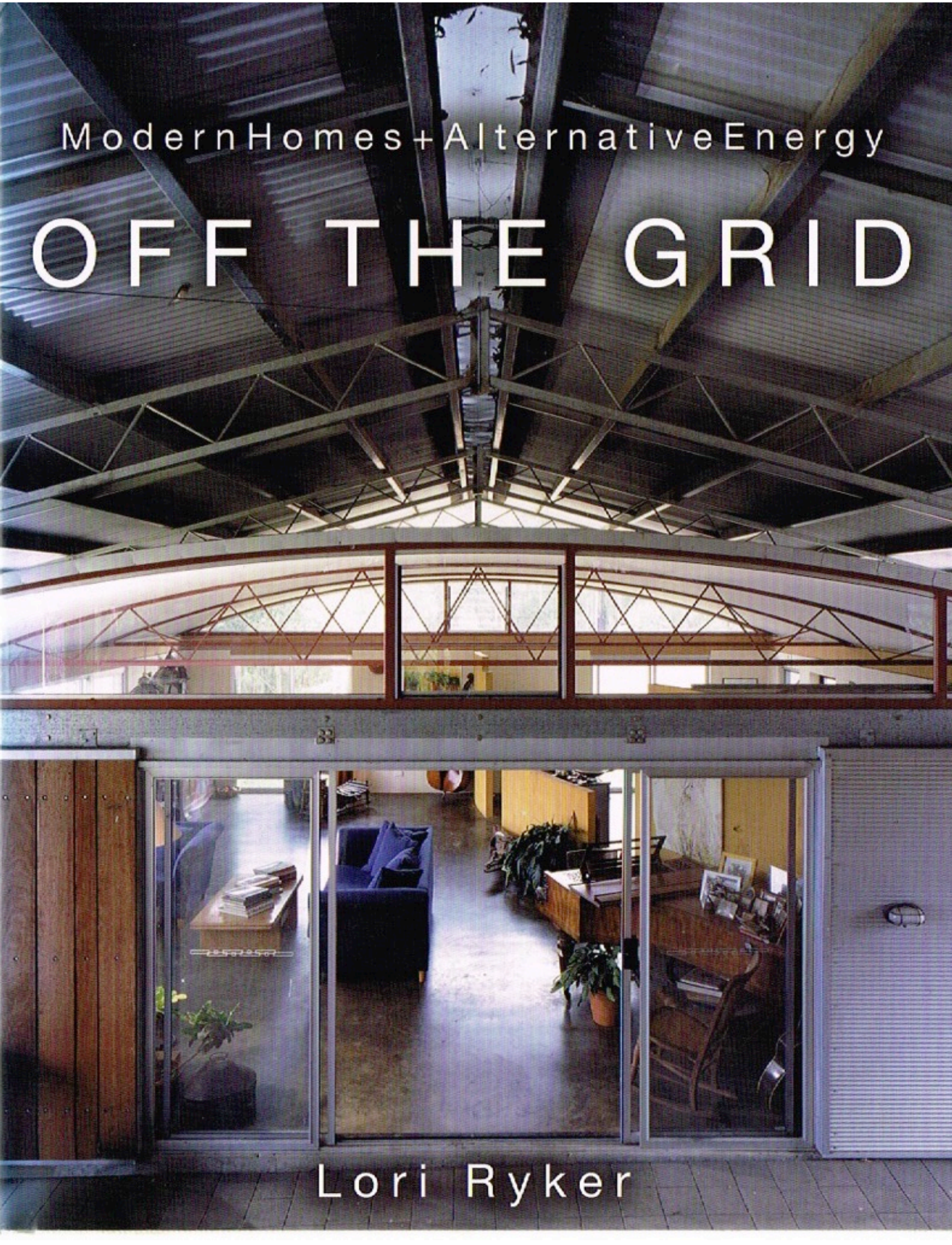
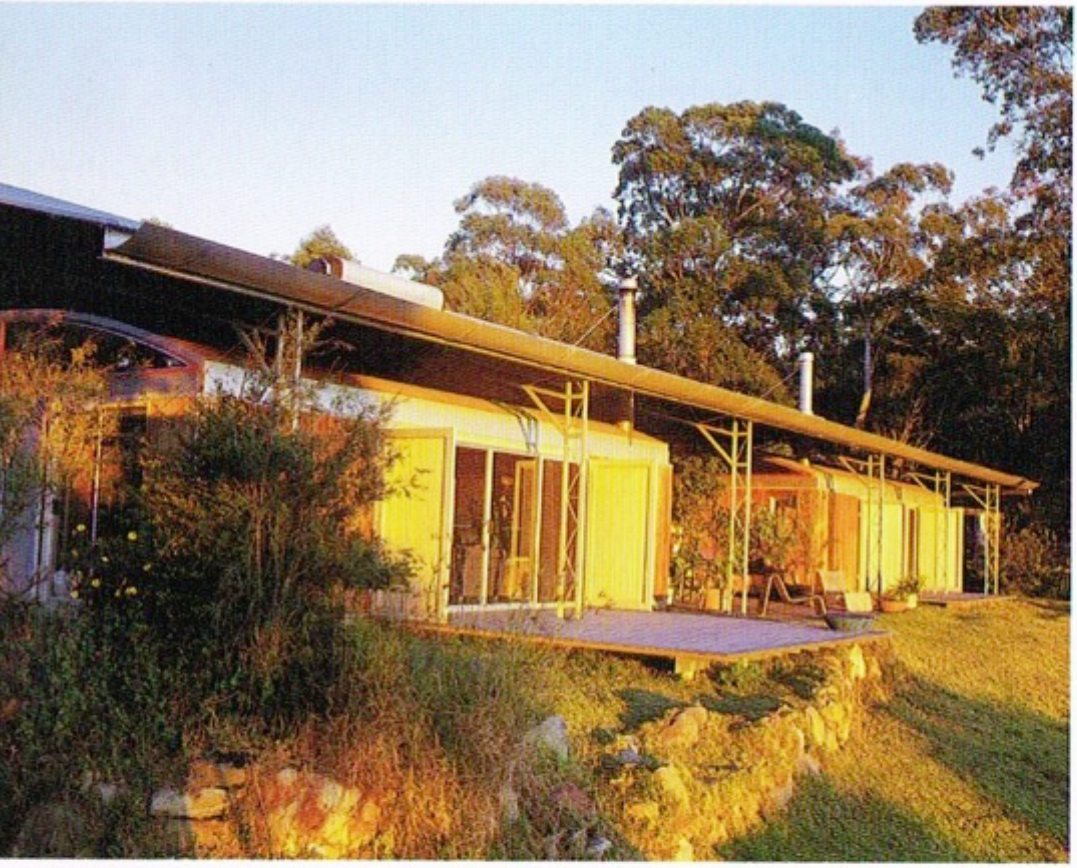

Modern Homes + Alternative Energy
OFF THE GRID
Lori Ryker

Aspiring to Self-Sufficiency

Lindsay Johnston, Architect The Four Horizons Autonomous House Watagans National Park, New South Wales, Australia

Four Horizons is located along the eastern coast of Australia, on the crest of a ridge at the northern edge of Watagans National Park, looking out onto the lower Hunt Valley. The locale is a truly remote environment where municipal systems of any type are unavailable. For Lindsay Johnston, the Autonomous House grew out of a personal challenge of self-sufficiency along with a commitment to take responsibility for how resources are used. In 1993, Johnston, an architect and professor, moved his home base from the city to Watagans National Park. Knowing that external opportunities for water, plumbing, power and communications were nonexistent, Johnston took on the serious task of designing the most efficient, well-designed, least environmentally obtrusive compound that could be built.



The Facts:

House: 1,800 square feet

Breezeway: 820 square feet

Technology

- Wood-burning stove and fireplace
- 8 55-watt photovoltaic panels by BP, plus solar power for telecommunication
- A battery bank of 24 BP no. 2P566 batteries
- Solar water heaters
- Water collection cisterns
- Dual-flush toilet

Dynamic Use of Energy

- A solar-powered uplink powers telecommunications.
- A wood-burning stove provides heat for the house; all the wood is collected from the forest floor, reducing the risk of fast-moving brush fires in the area.
- The town sports car was traded in for a more efficient 650cc 2-cylinder Subaru.
- Gray water from domestic use is used to water the vegetable garden.
- Water collection, in three locations, is used for domestic requirements, the vegetable garden, and fire-suppression support.
- Solar water heaters heat all domestic hot water.
- The dual-flush toilet conserves clean water, using it first in the sink and then for flushing.

Other Energy

- Food refrigeration and cooking, and hot water backup are powered by propane.
- A generator by Lister is used for backup electrical requirements and powered by diesel.
- A conventional septic system was installed for toilet discharge only.

Materials of Interest

- Recycled poly/wool wall insulation
- "Color panel" steel agricultural frames made in Australia
- Concrete floors finished with Livos Hard Oil and Livos Glevivo Liquid Wax, products that contain beeswax, shellac wax, pine oil, rosemary oil, and carnuba wax

This page: The end of the living volume opening onto the courtyard breezeway makes visible the double-roofed system and its rooftop ventilation for the escape of hot air. The cap is made from a transparent material doubling as a skylight.

Facing page: Winter sun stretches across the landscape, moving into the house. Concrete floors act as a heat sink to retain the solar heat throughout the night.

Autonomous House is a study in observation, measure, and care. Two separate interior spaces, which contain the basics of the two-bedroom house, are joined together by an outdoor room with a preexisting fireplace, to create a center for the new home. The living spaces are sheltered by an independent roof that floats over the enclosures, providing additional insulation and protection. The "fly" roof was developed from the agricultural steel shed frame, locally manufactured in New South Wales, and a common sight in this rural, agricultural area. The environmental lessons of Autonomous House do not stop at its doorway. Vegetable garden, solar panels, water collection, and the volume of gas that would be used in the car to get to and from the home were all considered when Johnston was determining the viability and credibility of living off the grid. Electricity, provided by a 440-watt array and a battery bank that stores power generated from the array, is incorporated as is a diesel generator. All water for the house is collected from the roofs of the house and garage and stored in steel and concrete tanks. The full tanks provide six months of water use. Located in the tree-shaded western side of the house and throughout the compound, they store an excess of water, ensuring a supply in case of drought or fire. Additional water is collected off of the stable roof for the garden and a dedicated firefighting supply.

This page: The courtyard breezeway, opening out to the valley view, is held between the two interior volumes, offering an exterior fireplace, hinged panels for reducing winter winds, and the opportunity to extend living to the outside while remaining covered. The roof superstructure provides a temperate canopy from inclement weather.

Facing page: Water-collection cisterns hold enough rainwater for all required water throughout the year: domestic water use, watering the gardens, and a six-month supply of water in case of drought or fire.

The inner workings of the home are well thought out and regularly monitored. The energy required for the refrigerator and stove is supplied by propane gas. Water is entirely heated by a rooftop, solar hot-water panel in the summer, with winter hot water backup provided by an integral propane backup boiler on the roof (the house requires an average of 18.7 pounds of propane fuel per week). Both of the interior spaces have wood-burning stoves to provide heat in the winter. The stove, located in the public side of the house, also serves as a baker's oven and cooktop. A dual-flush toilet, where water is first used for washing hands, then held for flushing, helps conserve water, releasing its discharge into a conventional septic system and drain field. All gray water from showers, sinks, and laundry is used to irrigate the garden.

Above: The "aperture" window in the bathroom shares the view to the outside through the bedroom, a great strategy for compact living.

Left: The living area presents a design strategy employed throughout both living volumes: minimal walls held down from the ceiling provide for great ventilation across the house.

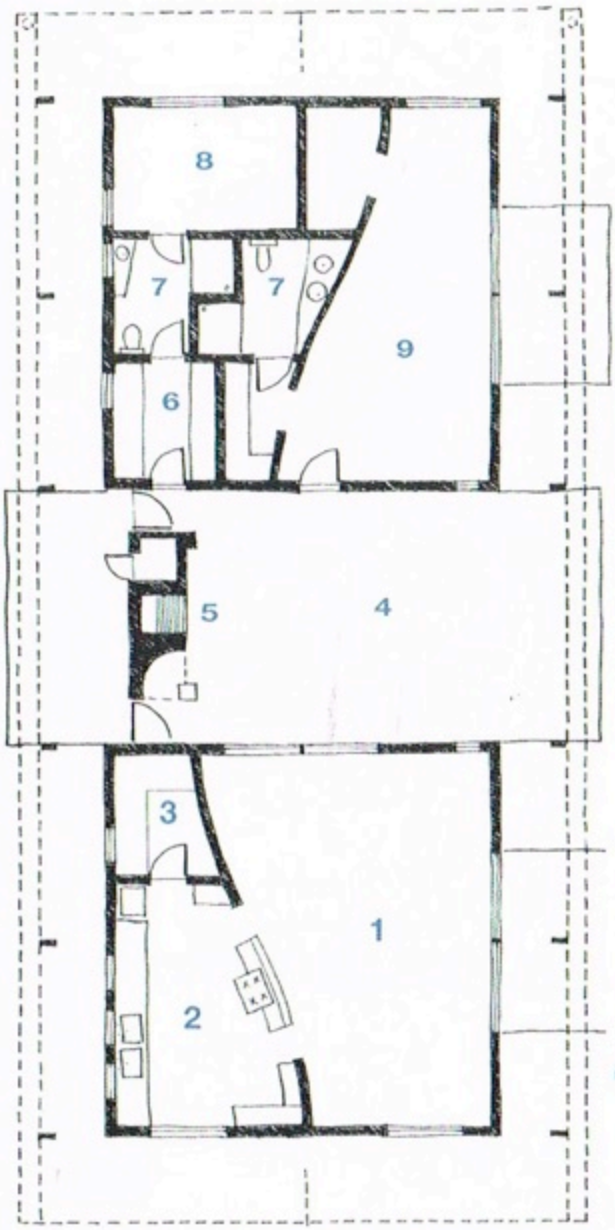
In order to develop an energy-efficient building, specific materials of construction and passive energy strategies were incorporated. The home is oriented to allow winter sun to enter the living areas, while the "fly"-roof overhang blocks out the high summer sun. In the summer, the center court collects breezes coming from the ocean, cooling the shaded interior and exterior rooms. The exterior room can also be shut off from these breezes in the winter. Large north-facing windows collect winter sun and small south-facing windows minimize the effect of winter weather. A filled-concrete-block wall runs through the middle of the interior portions of the house, providing a thermal mass that stores winter sun for release into the rooms later in the day. Concrete floors and exterior block walls provide thermal mass to retain coolness in the summer and warmth in the winter. The exterior of the building's south, east, and west exterior walls are clad with small-profile corrugated steel and insulated with recycled polyester/wool insulation.

The Autonomous House demonstrates that living can occur quite conscientiously even when some energy needs require fossil fuel. Overall, the embodied energy and energy consumption of this house is less than that of a typical grid-intertied home. Future improvements could be made with additional photovoltaic panels and/or a wind turbine to make the home even more self-sufficient and less reliant on the limited resources of the planet.

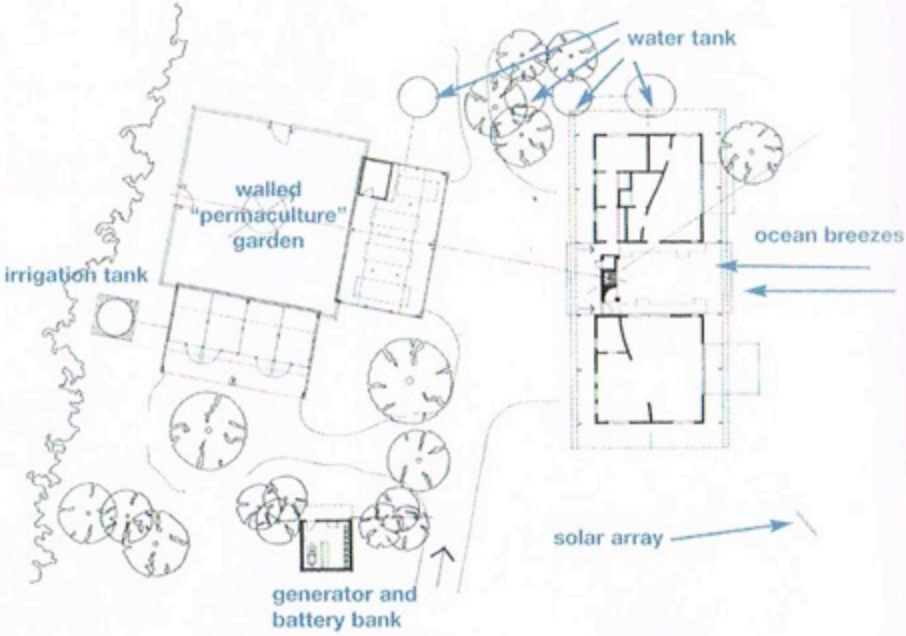
Above: A small solar-powered satellite tower provides the connection for phone and Internet.

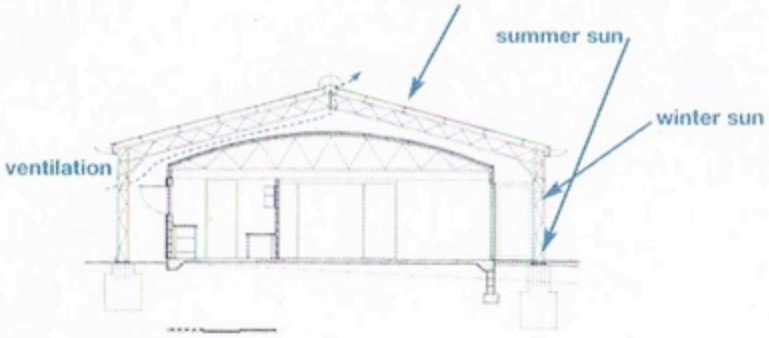
Left: The bedroom's lowered interior wall allows cross ventilation, an effective passive cooling strategy.

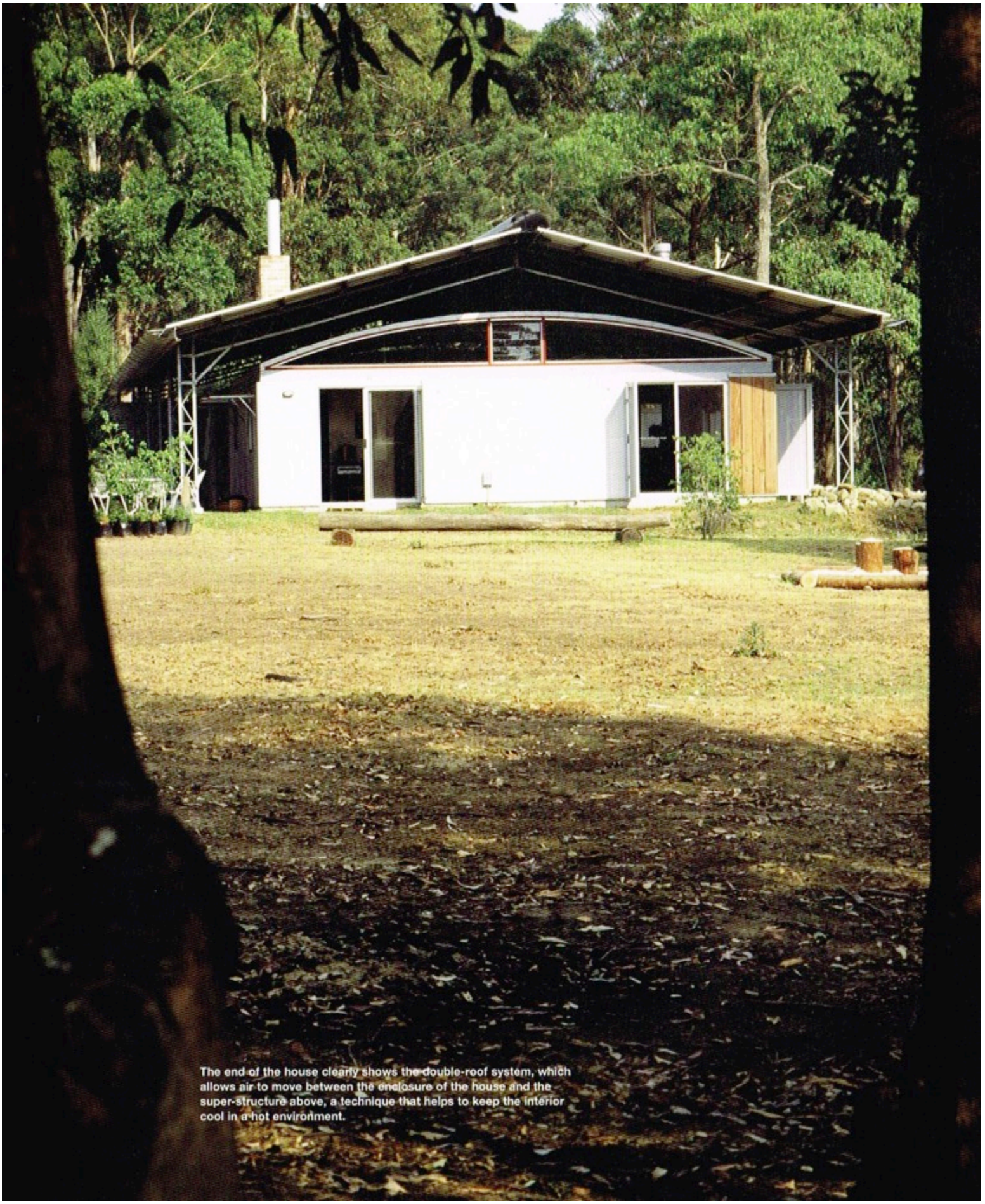
Right: Detail of hinged, metal door shutters, which provide versatility to the glass-door openings. The doors operate independently allowing for passage or blockage of light, depending on the season. They can also close completely in harsh weather or when the family is away. The roof superstructure, which encompasses the entire interior space, has a large rain gutter attached to capture all water and collect it into the cisterns throughout the home.



1 LIVING ROOM
2 KITCHEN
3 PANTRY
4 OUTDOOR BREEZEWAY
5 FIRE
6 LAUNDRY
7 BATHROOM
8 BEDROOM
9 MASTER BEDROOM







The end of the house clearly shows the double-roof system, which allows air to move between the enclosure of the house and the super-structure above, a technique that helps to keep the interior cool in a hot environment.