

Arrillhjere Demonstration House

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Introduction

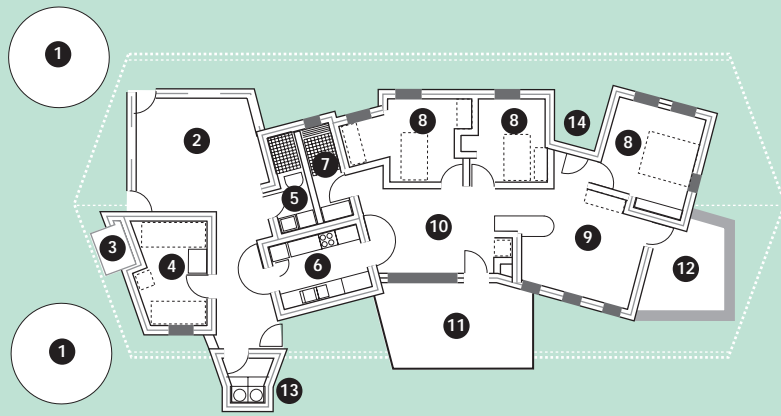
The Arrillhjere Demonstration House was conceived by Mrs Olive Veverbrants Peltharre of the Arrillhjere Aboriginal Corporation, as the centrepiece of an environmental learning centre for Indigenous people in Central Australia. This centre demonstrates

contemporary, self-sufficient living which is in harmony with nature. The built environment makes use of appropriate design and sustainable building technologies and incorporates modern appliances. The project aims to have the potential for general application to small remote communities of Indigenous people.

Project Brief

The Arrillhjere Demonstration House is situated in the harsh, arid-zone climate of Central Australia and has no networked electrical or water services. The four-bedroom house was thus designed to operate independently, with its own water collection and energy systems





- | | |
|------------------------------|-------------------------|
| 1 Rainwater tanks | 8 Bedrooms |
| 2 Flyscreened verandah | 9 Living room |
| 3 Store | 10 Eating area |
| 4 Instructors' sleeping area | 11 Verandah |
| 5 Laundry | 12 Future sleeping area |
| 6 Kitchen | 13 Latrines |
| 7 Bathroom | 14 Entrance |

Plan of the Arrillhjere Demonstration House.

keeping running costs to a minimum. The land around the house has been developed as an arid-zone permaculture garden.

The project also provided an opportunity to test and demonstrate an alternative procurement process combining construction management with a training programme to foster local Indigenous participation in the construction. The Arrillhjere Demonstration House was entirely a local project, undertaken by various groups from Alice Springs.

Design Features

Structurally, the house is characterised by a self-supporting, steel-framed umbrella roof, designed to create shaded outdoor spaces and to shade the external walls of the building (see the plan above). The enclosed floor area of the house is 135 m², while the overall roof area amounts to an extensive 252 m², that is,

1.86 times the floor area. This allows visiting trainers, who reside in a separate sleeping accommodation, to get access to the kitchen, shower, laundry and toilet without entering the main private living area.

In keeping with the goal of providing an affordable, environmentally-appropriate, contemporary house for a typical hot and dry arid location such as Alice Springs, the following key design features have been chosen:

- ▼ thermal mass walls and floors (cement- and bitumen-stabilised rammed earth)
- ▼ high internal ceilings of an insulated sandwich type
- ▼ white corrugated steel roof with wide overhang to provide extensively shaded outdoor living areas
- ▼ passive ventilation system through five stationary ridge vents connected by flexible duct to ceiling registers.

Energy Services

As rainwater is scarce (typically 410 mm per year), it is harvested from the roof, and stored in two 22.75 m³ galvanised steel tanks. Water is then distributed at need via a 500 litre header tank, from which it is drawn by gravity to the house where water-saving fittings are attached to shower and sinks.

A 720 W solar electric system was installed consisting of six monocrystalline photovoltaic panels. As winter days are usually sunny, the panels are mounted due-north on the roof which has been designed with an ideal slope for winter sun exposure of 24 degrees. The system is connected to a bank of flooded-cell, lead-acid batteries (24 VDC, 450 Ah) managed by a regulator. A dc-to-ac sine wave power inverter with a rated capacity of 2.2 kW has been installed. On a typically cloud-free winter day in Alice Springs, the 720 W photovoltaic array produces of the order of 3.2–3.4 kWh of solar electricity per day. Energy-efficient electrical appliances have been installed throughout the whole house.

A frost-proof solar hot water system comprising a 2 m² collector connected to a jacketed 180 litre water tank has been installed next to the solar power system. The hot water unit performs as a vented system in conjunction with a fuel-based booster.

Space heating, cooking, baking, and solar hot water boosting are all provided by a wood-fired, slow-combustion oven. The oven is situated in the centre of the living area and is typically used during the

four winter months. For the rest of the year, bottled liquid petroleum gas (LPG) is used for the separate kitchen stove. An LPG-operated refrigerator is being used until financing can be secured for a high-efficiency electric unit and the enlargement of the solar power plant.

The Arrillhjere Demonstration House has minimal energy running costs by Australian remote area standards, the only energy purchased being bottled LPG for the kitchen stove and refrigerator. The annual consumption of LPG is typically close to 500 litres (or about 12 GJ), valued at somewhat less than AU\$300 per year (where AU\$ is the Australian dollar). Any firewood needed for the oven is sourced locally from around the site. The fire is also fed by paper briquettes made from recycled newspapers to supplement the wood supply.

Waste Streams

A dry, double-batch composting toilet has been integrated into the main house. The waste water from the bathroom, the kitchen and the laundry is directed to a gravel trench which feeds the roots of the fruit-tree orchard. Household waste is kept to a minimum and sorted for organic matter (composting) and recyclable material.

Economics

It is difficult to provide meaningful costings for the house because this was a demonstration project which was conducted in a non-conventional way. Nevertheless, the total cost of all materials, equipment, appliances, management and the main part of the labour for this house was

AU\$142,000. If translated into commercial reality, an estimated worth of about AU\$23,000 in labour costs has been provided through the subsidised training programmes which formed part of the project.

The net cumulative costs of only the ‘sustainable technology’ components of this arid-zone learning centre, for example, amounted to AU\$40,050 and are summarised in the table below.

Environmental Impact

The project tried to use as much local material as possible, contributing to low embodied energy in construction. All waste materials have been stored on-site for later re-use. Paper and cardboard are mostly being re-used in the permaculture gardens. The site has been extensively re-habilitated after construction, with emphasis on re-generation of native plants and planting of food and shade plants. By operating with a limited amount of fossil fuels, the Arrillhjere Demonstration House is keeping its greenhouse gas emissions to a minimum.

Conclusion

As an environmental learning centre, this demonstration project proves to be very successful and therefore hopes to positively influence other arid-zone communities to pursue ecologically sustainable development principles.

For more information contact the CADET Australian National Team in Canberra.

Cost of ‘Sustainable Technology’ Components
for the Arrillhjere Demonstration House

| Item | Costs [AU\$] |
|---|--------------|
| Rainwater harvesting system | 10,000 |
| Additional shading system | 11,400 |
| Passive ventilation system | 1,650 |
| Complete electrical system (incl. AU\$16,000 for the solar power system) | 20,000 |
| Solar hot water system | 1,800 |
| Slow combustion wood oven system | 2,000 |
| Savings of composting toilet versus septic tank | 0 |
| Savings due to mud-brick walls | 3,300 |
| Savings due to rammed-earth wall footings | 2,000 |
| Savings due to poured-earth verandah floors | 1,500 |
| Total extra cost compared to “conventional” house | 40,050 |