

# TROPICAL SUSTAINABLE DESIGN CASE STUDIES

## The Sunbird House

Project type: Residential

Location: Edge Hill, Cairns, QLD, Australia

Year completed: 2001

- Extensive use of passive design for shade and natural ventilation and renewable energy use
- Sustainably sourced materials suitable for durability and low maintenance in the tropical climate

### OVERVIEW



The Sunbird house was conceived as a demonstration project to break new ground and showcase expertise in tropical design and construction. It was built at a time when roof insulation was still an optional extra for many Cairns builders. Project highlights include the use of sustainable materials, energy saving technology, low emission living and passive design principles in tropical Queensland. The house was awarded a Master Builder's Association Energy Aware Home Award in 2002. It was open for inspection to the public for Sustainable House Day in 2008.

Sunbird house is of semi-traditional construction and its key features include: climatically appropriate passive design; extensive use of sustainably harvested timbers; materials selected on the basis of low embodied energy, toxicity and local availability; solar energy and solar hot water; on-site collection and storage of 75% of annual water needs; and a composting toilet to reduce wastewater and appropriate native plant site revegetation.

## SITE

The home is situated in Edge Hill, an inner suburb of Cairns. It is about 8 km from the city centre and within a few minutes' walk to the Cairns Botanical Gardens. The site is rectangular in shape and slightly sloping. The front boundary faces east with the long boundaries to the North and South. The topography and built environment of the immediate area is clear of obstructions to light and prevailing breezes. The site is generally well suited for a passively ventilated house design with solar energy technology.



Site earthworks were kept to a minimum as a post and beam construction style was chosen negating the need to bench (flatten) the house site. This choice reduces the disturbance of top soils and the risk of soil erosion and run-off during the construction period.

## DESIGN

Passive design principles focus on orientating the house to prevailing south-easterly winds (all bedrooms and living areas face these breezes) and creating convection currents through the house by the use of ridge vents, slatted ceilings, high level (clerestory) louvres and strategic window placement.

The house is raised approximately 600mm on stumps promoting under-floor ventilation. The elevated floor level also helps reduce visits from low flying insects and toads.



Walls and windows are generally shaded from the sun by verandahs, roof overhangs or awnings. They are strategically positioned to provide additional climate control as they help shade the house. Outdoor living decks, verandahs and patios are an integral part of the Cairns lifestyle.

Window systems are designed to be left open even in rainy conditions, thus ensuring constant airflow through the house. This also helps to reduce condensation and mould in the wet season. Westerly windows are glazed with tinted glass to further reduce solar heat loads.

The house is of 'lightweight' construction, being built of timber. This lack of 'thermal mass' means it will cool down very quickly in the early evening, unlike a masonry house. The roof and walls are a light colour to reflect heat.

The home has lots of natural light as houses can be quite dark in the wet season leading to increased electric light use.



The endemic re-vegetation and landscaping in the yard area provides further shading and temperature modification opportunities.

## MATERIALS

Materials were selected on the basis of life cycle costing and environmental impacts including toxicity, mining and processing impacts and embodied energy. High embodied energy concrete and steel were limited to footings and stumps

The house is constructed mostly of timbers that were sustainably harvested on the Atherton Tablelands, including structural framing, linings, cladding, flooring, joinery and windows.

There is very minimal use of PVC and copper throughout the project, with alternative products such as HDPE used wherever possible, including the entire water supply and drainage system.

The roof is fully insulated with a non-fibrous insulation product, and all walls have been lined with reflective sarking.

Local employment was considered with timber, joinery and metalwork all sourced locally.

## ENERGY

The house maintains a comfortable temperature supported by passive design principles therefore mechanical cooling is limited to ceiling fans and no air-conditioning is needed.

Energy efficient appliances such as dishwasher, washing machine and refrigerator (five star ratings) reduce energy use.

Energy efficient lighting, especially compact fluorescents makes a surprisingly large difference and the design features lots of natural light.



A covered drying area negates the reliance on an electric clothes dryer.

A solar hot water system has a manual boost switch and it only needs boosting a few times a year during the cloudy wet season.

The gas stove and cooking has lower greenhouse gas emissions than electricity from coal fired power.

Solar panels on the roof produce day time energy needs. It is a grid-connect system with battery back-up.

It is estimated that the average daily energy consumption is 10 kilo-watt hours or less. The solar energy system meets or exceeds 100% of this demand.

## WATER AND WASTE

All water based appliances are five star rated for water efficiency. All taps and showers are rated for water efficiency as is the dual flush toilet. A composting toilet as a second toilet further reduces water consumption.

Three rainwater tanks can deliver up to 75% of the annual household water consumption.

The site has also been re-vegetated to restore endemic vegetation which will survive with minimal irrigation.

## OWNERS/USERS STATEMENT

“It is a practical house in which to live. We bought the house after going to the original open day in 2001. For us it just embraced all the concepts we wanted from the tropics and had very sensible applications.”  
Laura

## PROJECT TEAM

Project manager/Base building architect/designer/Interior designer: Studio Mango

Structural engineer: CMG Engineering

Services engineer: (mechanical electrical, hydraulic, fire): Gilboy Hydraulic Solutions and SPA Engineering

Builder: Max Bryant Constructions (now Bryant Qld)

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