

# house – hot humid

**This home was designed and built to improve year round thermal comfort and health for its occupants whilst reducing its overall environmental impact.**

**It has succeeded by reducing energy, water and non-renewable resource consumption, minimising waste output and eliminating toxic materials.**

Building Type:	New home, Lightweight construction
Climate:	Warm temperate Queensland, Gold Coast
Topics Covered	Success Level
Passive design	Very Good
Lifestyle modification	Very Good
Rainwater harvesting	Excellent
Waste reduction	Excellent
Recycled/renewable material use	Excellent
Greenhouse gas reductions	Excellent
Indoor air quality	Excellent
Reducing Water Use	Excellent
BERS rating – 4 stars	★★★★

This two storey, fibre cement and corrugated steel clad modern Queenslander was built as a sanctuary to nurture children in a healthy environment. It was designed to consume less energy in construction and operation, have a minimal ecological impact and maximise passively controlled internal environments for occupant comfort, health and optimal indoor air quality.

Located on the Gold Coast just 200m from the beach, the healthy home helps demonstrate what can be achieved in sustainable housing in a sub tropical climate. It works with the climate and was designed and built to respect the site.

The house is aesthetically pleasing and significantly reduced impacts on resources, both in construction and during the life cycle of the building. Through energy efficient design, using a solar hot water system and providing its own solar energy the owners achieve an overall saving of \$600 to \$750 a year and a 70 percent reduction in household greenhouse gas production.

## DESIGN SOLUTIONS

The house has north orientation and appropriate shading to provide solar access in winter and solar exclusion in summer. Dual separate pavilions are linked by a common louvred breezeway.



Centre for Sustainable Design, University of QLD

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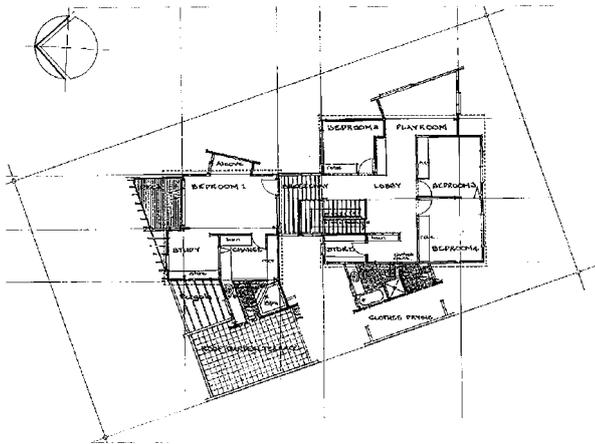
Gold Coast

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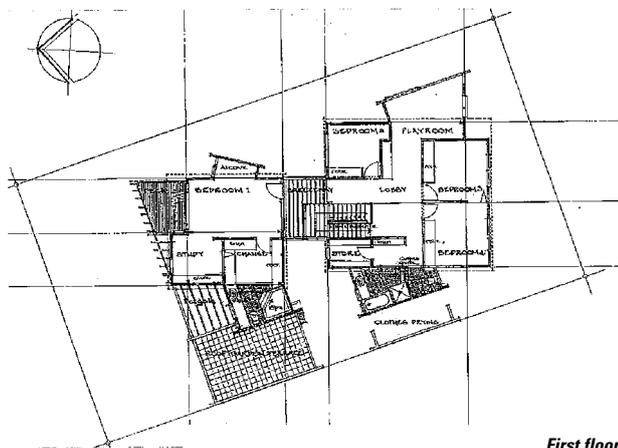
Home

Raised, suspended timber decks are used at the entry and elsewhere for outdoor living. The pavilion plan form with open section provides cross ventilation for summer cooling.

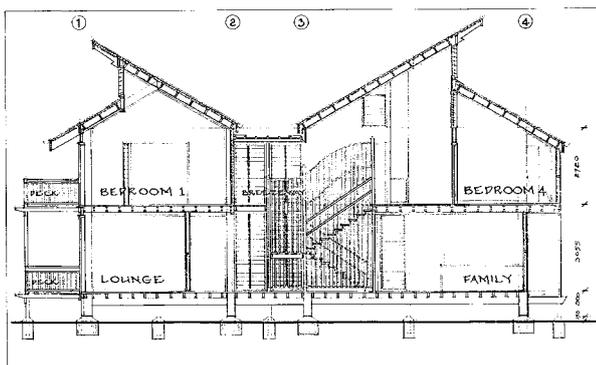
The factory prefabricated skeletal frame system gives internal planning flexibility and maximises openings for ventilation.



Ground floor



First floor



Section

The downstairs open plan kitchen, dining and family areas are also linked through entry and breezeway to a formal downstairs lounge. All have three metre ceilings. The use of the breezeway and a water feature promotes ventilation and evaporative cooling between the pavilions.

**Ground connected mass** construction to the lower storey evens out day/night temperatures.

**Detached utility and storage areas** buffer living areas from westerly sun and heat gain.

**Interior atrium space** with recycled timber and stainless steel wire balustrades promotes convective cooling in calm summer conditions and allows ample light into living areas.

## INSULATION

**Thorough draft proofing** (including door and window seals) exclude sound, rain, cold draughts, dust, light, insects and vermin. This reduces overall heat loss by 12 percent which is a cost effective method for saving energy.

**Breather wall insulation** allows free passage of air and water vapour through the breather sheet to avoid condensation and provides two reflective air spaces for efficient insulation. Whilst this insulation system is currently not rated under national standards, significant research indicates that it is an effective system in warm and hot climates. The system will be rated in the near future.



**The aluminium foil insulation** shown above with a 25mm reflective air gap each side stops 97 percent of radiant heat. It is economical, efficient, non-irritant, non-allergenic and recyclable. An under roof insulation blanket provides condensation insulation to the steel clad roof and walls.

## WINDOW

**Louvre windows** provide maximum ventilated window space, controlled indoor airflow and air exchange. Window glazing systems were carefully analysed early in the design stage. Smart window technology reduces solar gain to interior spaces.

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**Maximum north facing** timber windows, timber bi-folds, french doors and louvers with a blue azulite tint glazing are used. The high performance glass absorbs a significant amount of the sun's near infra-red heat energy and reduces the transfer of heat into the home. [See: [Glazing Overview](#)]

**Excellent visible light transmission** means the interior of the home is illuminated by natural light. Electric lighting is not needed in daytime. North exposed window hoods provide passive solar control for summer cooling and winter warmth. Pelmeted roman and roll blinds are equivalent to R0.5 insulation on windows reducing winter heat loss. They also reduce summer glare and direct light penetration.

**Adjustable shade cloths** maximise daylighting whilst providing solar control on east and west exposures.

## SUSTAINABLE MATERIALS USE

**The pre-painted steel roof** with clerestory pop-outs is resilient, versatile, light and corrosion resistant. It is 70 percent recycled, has superior strength and collects drinking water quality rainwater. It is also thermally efficient and has a very good product life span.

**Fibre cement** internal and external cladding is manufactured with minimal environmental impact, has low embodied energy and an excellent lifespan. The ingredients (cellulose fibre, portland cement and sand) are non combustible and termite resistant, easy to work with, durable, low maintenance, versatile, flexible, easy to paint and resistant to weathering.



**Australian tiles** with lower embodied energy than imported equivalents were laid into wet concrete, eliminating the need for harmful outgassing glues.

**Recycled aggregate concrete** was used to reduce embodied energy and environmental impact by reusing existing high embodied energy materials.

**Solid recycled and plantation timber** cabinets were used to minimise outgassing.

**Recycled Australian hardwood timbers** were also used throughout to reuse resources. Tongue and groove flooring, posts, railings, stairs, floor and decking timber and joinery were all remilled. For more information, visit: <http://timbershop.wilderness.org.au/product/internalapps.html>



**De-nailed**, stress graded, recycled structural hardwood and decking timber was used to reduce embodied energy. Timber doors and windows from sustainable forest plantation hoop pine were installed throughout the home.

**The engineered timber** structural frame was prefabricated in a factory. This reduced waste and site impact, limited excavation and sped up the construction. The building envelope skirt ties the lightweight frame to the thermal mass of earth and concrete for summer cooling and winter warmth.

## INTERNAL FINISHES AND INDOOR AIR QUALITY

**Lime wash paints** were used because they are made from natural pigments with low environmental impact in manufacture. There is no harmful off gassing, which provides optimum indoor air quality for a low life-cycle cost.

**Natural oil timber finishes** were used externally and internally and non VOC emitting waterproofing also helps maintain optimum indoor air quality.

**A ducted vacuum system** effectively cleans the carpets, is quiet and dirt and dust are deposited into the unit dustbin and not recirculated throughout the home. It provides clean air and has four-stage filtration for more efficiency and longer machine life.

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## WATER

A **water flow control** system reduces water use by up to 50 percent and controls the amount of hot water used, saving heating energy. This system eliminates dangerous and annoying temperature fluctuations in the shower, balancing the hot and cold water system.

The **triple filtered rainwater storage** system has a self-cleaning filter. Dirt and pollutants bypass the tank and pass through a 30 micron filter. The storage system is food-grade “aquaplate”, with a patented diversion system and 20 year warranty.

A **22500 litre concrete rain water tank** is installed for storage and utilisation of rain water in the laundry, kitchen, bathrooms and garden sub-surface watering system.

The **first flush device** using a treatment and water filter ensures drinking water quality and has a manually controlled mains refill capacity for when the stored rain water runs low.

**Ultraviolet water disinfection** ensures pure, healthy drinking water. **Polypropylene** piping ensures a high quality uncontaminated water supply for life.

**High-density** polyethylene plumbing and ducting used is highly durable, non-PVC, with minimum environmental impact in manufacture or assembly.

A **grey water treatment system** allows for grey water reuse and will reduce the load on the council treatment plant when fully operational.

## ELECTRICAL SYSTEM

**Environmentally friendly lighting** saves energy, costs less to run and reduces hazardous material content. It lasts 8–10 times longer and uses less fossil fuels, reducing greenhouse gas emissions.

**Energy and water efficient white goods** are used. They are 95 percent recyclable, create less greenhouse gas and have a low life-cycle cost. They conform to the best energy and water conservation standards.

A **grid connected photovoltaic array** has been installed and is being monitored. The system aims to supply the home and export surplus energy to the grid while producing no greenhouse gases.

**Electrical cables are PVC free**, which improves insulation characteristics, has higher mechanical strength and fire performance. They are self extinguishing, flame retardant and reduce smoke generation and toxicity of fumes in a fire.

## LANDSCAPING

Rock paths linking balconies meander through a permaculture garden that provides fresh herbs and fruit. Native plants attract fauna and complement the landscape. The free form rock paving and pebbles used in landscaping have a low environmental impact and are functional, durable, low maintenance and have low embodied energy. These materials are readily available, recyclable and cost effective.

A recycled tyre, subsurface drip-filter irrigation system in the garden minimises water usage for maximum benefit and may be connected to the grey water system in the future.

## EVALUATION

**“We wanted to ensure our children’s health and their planetary inheritance ... and establish a sustainable development blueprint to show others what can be achieved.”**

We aimed to produce a benchmark blueprint residential development with the help of experts in order to research and inform people about environmentally friendly and energy efficient design and building techniques.

We now benefit from optimum indoor air quality in a passively controlled, comfortable and functionally aesthetic house that has low running costs and low environmental impact. Through constant daily monitoring, we have become more aware of our daily habits, use of energy, water and other resources. We interact with climatic conditions that provide us with energy, water and growth for our garden. On another level, it has given us great pride in our achievements and an ability to encourage others to follow in our footsteps.

## FURTHER INFORMATION

The Healthy Home Project brought together Queensland’s leading Universities and Government Departments in a joint venture with energy efficient and environmentally sustainable industry partners.

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