INTRODUCTION

In 1997, we moved to Northern NSW, Australia near the Border Ranges and purchased a 5 acre bush block. Neither of us had had any experience in building or using power tools. We were in fact complete novices. Nevertheless, we chose to live a pioneering existence whilst we took on the task of designing and building our own energy efficient, chemical free home.

For us an energy efficient home is one that incorporates the renewable energies of nature to sustain our life. We wanted to use the sun's power to provide us with electricity, heat our water and to passively heat the house in the colder months. We wanted to incorporate the natural flow of breezes to passively cool our house during the hotter months. It is important for us to collect and filter the rainwater and to harvest our own firewood. Being able to use these renewable aspects of nature meant we could live off the grid and not place any burden on the 'system' that employs unsustainable environmental practices to bring us electricity, water and to remove and treat our effluent.

We wanted to design a passive solar home that would maximise the potential of these aspects of nature and to provide us with the greatest energy efficiency as possible whilst at the same time decreasing any wastage of this energy. We also designed a stand-alone toilet system that would meet these requirements.

It was our desire to eliminate all electricity and water bills and not to pay for the removal and treatment of our effluent. We would then have a self-sustaining, energy efficient house with a minimal carbon footprint.

To decrease our impact on the earth's resources and at the same time reduce our costs, we chose to mill our own building timber harvested from the land and to use second hand structural timbers and second hand windows and doors.

We live in a sub-tropical climate, which has hot summers and mild winters with cold nights. Our gently undulating block is north facing and being completely off the grid requires stand-alone power, rainwater tanks for domestic use and irrigation water from a dam.

As owner builders, we built a pole home with a simple skillion roof. We chose a passive solar design to achieve our goal for an energy efficient house.

We hope this book will provide enough information on how we designed and built our home so to inspire you to achieve your dream to design and build a beautiful, sustainable, energy efficient home.

What Is A Passive Solar Home?

This is a house design which maximises the winter sun that enters the house and then stores this heat to keep it warm throughout the day and night. It will also minimise the summer sun entering whilst allowing cool air to flow through the house. This design greatly increases energy efficiency whilst removing our energy bills and decreasing our carbon footprint by allowing the sun to do the passive heating and the design to do the passive cooling.

Orientating Our House For Maximum Energy Efficiency

The most important thing we did was to sit at our chosen house site on the winter and summer solstices to observe the path of the sun in order to determine the optimum direction to face the house.

We found the optimum aspect for our house was north. This allows us to fully capture the winter sun, which sits at its lowest point in the northern sky at that time of the year. As a result of capturing this winter sun our house is being passively warmed which lessens our dependency on other forms of heating.

In the Northern Hemisphere the reverse happens. Therefore, the best orientation is south.

We found that it is important to have no trees blocking the winter sun. And conversely, it is an advantage to have trees on the western side of the house to provide shade from the hot afternoon summer sun. Trees can also act as a windbreak to prevailing winter winds.

House Design

For us this was the most important part. We were not in a rush to build as we were working to save money for our future home. We took two and half years to finalise our plans. In that time we considered what we really needed for our ideal home. We were forever taking the tape measure to friends' houses, reading building literature, talking to locals and liasing with the local council regarding the building specifications.

We learnt that we would be building upon clay that would expand when moist and contract in the dry, so there would be some movement in the earth that we would be building upon. We could expect that Northern NSW would have hot wet summers and mild winters with cold nights; and the prevailing winds would come from the south in winter and the north in the summer.

With this knowledge and the desire to build an aesthetically pleasing energy efficient home, we began to draw our own plans.

We decided on an open planned, two bedroom pole home with a skillion roof.

A Pole Home

- As our block is gently sloping down from the back of the house i.e. from the south to the north, a pole home would allow us to build on this slope without having to bring in heavy machinery to excavate a flat house site.
- As we were to build on clay, a pole-home would have the advantage to compensate for any movement in the earth, whereas a fixed concrete slab is rigid and could possibly crack. We have in fact found that some of the poles have had slight movement, all due to changes in the moisture content of the clay, with the house showing no structural damage.
- A pole home can allow for movement of water under the house in wet times and cool air to flow under the floors in the hot months.
- With a pole home we could erect the roof before building the walls and floors thus giving us protection from the elements.

Open Plan

Open plan refers to a design that minimises walls and therefore the number of rooms. For us this meant less building and materials, whilst optimising the amount of light, warmth and airflow entering the house.

- We kept the design as spacious as possible with the thought that we would be having children in the future.

Skillion Roof

- A skillion roof is a single flat sloping roof.
- Easy to build.
- Our roof slopes from the North (the highest point) to the South at an angle of 8.5º. This allows full winter sun to enter in the North and prevents the summer sun from entering in the South.
- The roof gives a large catchment to fill the rainwater tank, requiring only one gutter at the lowest point.

Natural Free "Air Con"

With the knowledge that hot air rises, the design of the skillion roof would allow the hot air to flow up the ceiling to the highest point where windows can be opened for the heat to escape. Once the hot air rises, cooler air will be drawn in through shaded windows, doors and the southern hallway. As this cool air heats then rises, the cycle continues. We have found that even on the hottest, stillest days where temperatures can reach 40°C there is always a gentle breeze being 'pulled' through the house. The house remains impressively cool.

Other Important Factors

- We incorporated the basic principles of Feng Shui into our design.
- We avoided designing any spaces that would not be used (dead spaces).
- We made sure that we did not place any external doors opposite each other to prevent the creation of thoroughfares or wind tunnels, thus avoiding poor Feng Shui where energy is funnelled straight out of the home.
- The land was dowsed to help determine our optimum house site.
- The tall shade trees were kept in the west to provide cooling shade in summer but cleared the necessary trees in the north to allow full access to the winter sun.
- We designed the house so that all water areas were in the same section i.e. kitchen, bathroom and laundry. This minimised our plumbing and therefore costs.
- Spacious verandas placed around the house to provide shade from the sun and protection from the rains.
- We wanted to build a house that would last for at least 100 years.

With these factors in mind, we commenced drawing the floor plans of our energy efficient house that would be simple enough for us beginners to build.

Prior to drafting our plans for council approval, we went to the beach and drew a full-scale 2-D replica of the house in the sand. We enjoyed a walk through the house and adjusted the size of the rooms where needed. We also made a cardboard scale model using sticks for the poles and a detachable roof for aerial viewing.

With two and half years of research, we moved from Byron Bay to the land to commence our pioneering life.