NEW DIRECTIONS IN passive solar architecture

Climatically responsive buildings have existed since man built the first dwellings. Every mature culture has their own traditional vernacular architecture invented from a unique set of environmental conditions to produce adaptable climatically responsive shelters. New Zealand is different due to having only being discovered in 1769. Replica colonial buildings were the primary influences with insights of a New Zealand architecture found in the 'Group architects' of the 1950's and continues to evolve with this current generation of architects.

World architecture changed around the late 1890's and can be pin pointed to Chicago America. This marked the dawn of modern architecture: an architecture informed by new robust construction methods (steel structures) able to withstand any climate, the invention of new technologies used to power buildings (electricity) and mechanical systems used to control them (air conditioning invented in 1902). Cheap and affordable energy significantly influenced the new modernist styles. The German Bauhaus school (1919-1933) was probably the most influential example of a minimalist modern architecture which explored an innovative machine- like aesthetic, disconnected from external environmental functions, reliant on technology and driven by a new design intellect.

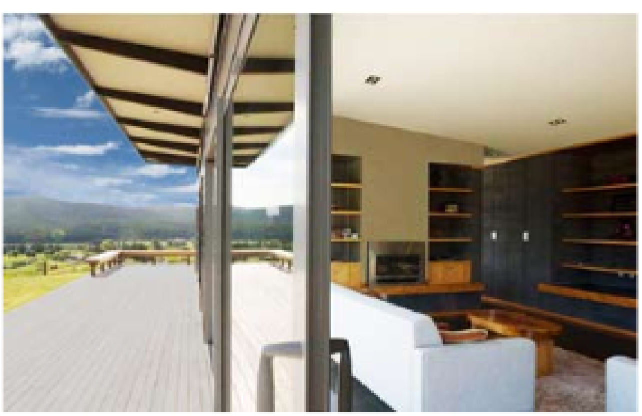
Fast forward to the 1973 and 1979 oil crisis which arguably brought America to its knees with New Zealand not far behind. During the mid to late 70's climatically responsive, low energy, passive solar buildings made their first appearance on the world stage and then disappeared as quickly as they arrived once the oil crisis was out of sight and affordable fossil fuel based energy was back on the menu. The seeds for a climatically responsive modern architecture had been laid and began to significantly re-surface 20 years later during the mid 1990's when climate change and environmental concerns gained global recognition and the internet accelerated the sharing of ideas.

The two houses featured are passive solar energy efficient homes designed for the New Zealand climate and environment. Developed from early ideas in passive solar design and assisted through better building technology as well as climate and energy monitoring technology. Primary consideration is given to energy conservation and passively achieving internal temperatures of 17- 24° during winter while remaining passively cool and comfortable over summer. Maximized northern aspect, window sizing, window locations, thermal mass, insulated glass, above code insulation and eaves design are

Above: Coatesville home

the critical ingredients which drives the design of the houses. Understanding how both houses respond to seasonal sun paths and wind flows informs how each house is laid out to take full advantage of natural airflow and invaluable sunlight which is captured and stored in the exposed aggregate polished concrete slabs and masonry block walls. Thermal mass works like a battery capturing and storing radiant energy from the sun during the day. In the evening when external temperatures drop, heat is then released from the concrete like a natural radiator. Heat will naturally dissipate out during the night warming the interior of the house. Concrete is able to retain heat over long periods of time without direct exposure to sunlight If designed and insulated correctly. During overcast days and depending on how cold it gets a back up heat source will be needed. This can be a gas or wood fire place and might be needed 5% of the time during winter.

Although passive solar houses are designed to naturally heat and control sun over the entire year, thermal mass will always continue to collect radiant energy from the sun over summer. Natural cooling is equally as important as heating. By utiising a natural stack effect (hot air rising) and designing for a centralised clerestorie, the house achieves a natural cooling affect. Clerestories are window openings located at high points in the roof and allow hot air to escape. If we design the house to bring in cool air from the exterior at a lower level this air will then gradually rise as excess heat is emitted from concrete slabs. The excess hot air will then be exhausted through the upper clerestorie creating a constant circulation of fresh air providing natural cooling.



Above: Te Kauwhata home

There is a lot of satisfaction seeing how concrete can be sustainably used to heat a house during winter, especially when the temperatures are minus zero degrees outside and the interior is warm and snug. The development of passive solar design principles are constantly improving through idea sharing and climate monitoring technology. Our goal is to find ways of improving houses based on passive design principles, better use of technology and creative thinking. ■

Written by Duncan Firth.