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PASSIVE HOUSE DESIGN STRATEGIES FOR NEW ZEALAND

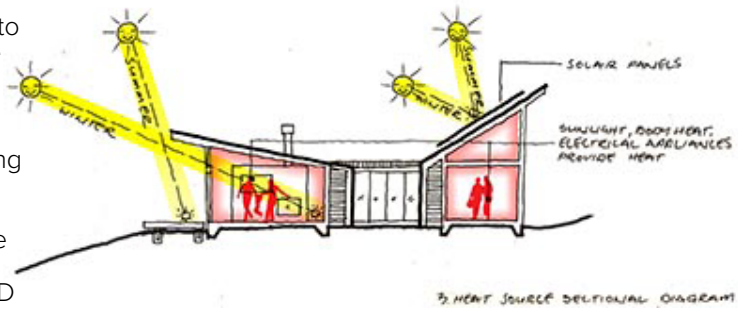
Modern passive house design ultimately relates to how we use other forms of energy, like heat from the sun, heat from humans and heat from electrical appliances (e.g. tv, computer, lights etc.) to heat and warm our houses. The idea is we use minimal direct forms of mechanical heating or cooling to provide energy efficient heating and comfort. The opposite is to use an active system like an HRV system (heat recovery ventilation) or HVAC system (heating, ventilating, and air conditioning) or a heat pump as we like to call then in New Zealand to provide warmth, cooling and comfort. The down side to these systems are, as soon as you switch them off during winter it gets cold and they add a significant cost to power bills when we use them.

The historical idea of passive design has been around since humans have lived in developed communities, which we call vernacular architecture. Building crafted buildings from specific climate types, environments and cultures. The Romans called it Genius Loci, the Chinese still call it Feng Shui and today we call it Environmental design. In recent times early modernist architect, Frank Lloyd Wright started combining passive solar design principles with his modernist houses during the 1940's, during the 1970's we saw an explosion in passive solar and environmental designs due to the oil crisis at the time, which then died off as oil prices dropped and during the mid-1990's we began to see the emergence of Passvihaus coming out of Germany. Add the internet into the mix we see an explosion in passive design strategies worldwide.

In its simplest form, there are essentially three key principles we make passive design from, Insulation, Air Tightness and a Heat Source. The goal is to achieve comfort, good health and energy efficiency.

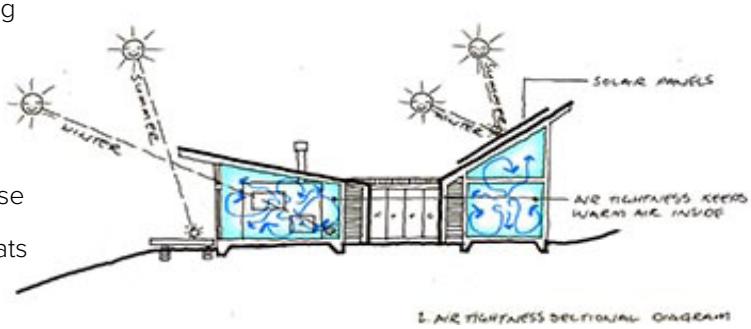
Ngunguru Road, Passive Solar House

Number one is Insulation and a thermally sealed building envelope where heat is unable to escape from solid surfaces. This requires an extremely well insulated floor, walls, ceilings and windows where heat is unable to escape through thermal bridging. Thermal bridging is where heat transfers from a solid warm surface to a colder surface through a process of thermal heat conduction, becoming cold in this case. e.g. A cold concrete slab loses heat through touching the earth or outside, an insulated concrete slab doesn't touch the earth so retains heat and is warm to walk on. Passive design aims to minimise or eliminate heat loss from solid surfaces inside the house through eliminating or reducing thermal bridging. The idea is to keep heat inside the house using a high level of insulation design. RED



3. HEAT SOURCE DIETIONAL DIAGRAM

Number two is retaining Air Tightness inside the home and preventing warm air from escaping to the outside. Typically this is achieved by a building wrap (which works as an air barrier) and covers the outside face of the framing. What typically happens is we add the building wrap around the building, but don't seal the gaps around windows, doors, fireplaces, HRV/HVAC pipes, vents, corners and so forth. This allows the warm air to trickle out of the house. In passive design the idea is we have warm solid objects that either stabilise air temperature or conduct heat. e.g. An insulated concrete slab, conducts heat to air, therefore warming it. The air warms up and transfer's heat to the human body, through convective heat transfer. If we have insulated solid objects inside a house which conduct heat, this continuously heats the air around us. BLUE



2. AIR TIGHTNESS DIETIONAL DIAGRAM

Number three is we require some form of Heat Source in the first place to heat a building. In passive design the heat source can be heat from the human body, heat from electrical appliances and heat from sunlight. The exact ratio depends on different situations for the climate region, personal requirements and preferred outcomes for the overall design outcome. It is possible to rely on human body heat, electrical appliances with a limited amount of sunlight to achieve comfort levels, and this might be the situation if you have a south facing site direction, windows sizes throughout the house would be limited. An ideal scenario is north orientation, with a good combination of large north facing windows relying on direction, passive solar gain, economical sized rooms, thermal mass (but not essential), small windows to the south, and moderate sized windows to the east and west.

The advantage with passive house designs is if we correctly insulate and seal them up for air tightness we have a good degree of flexibility in regards to the heat source we can rely on for each different situation, while still achieving the overall goals of comfort, health and energy efficiency. ■

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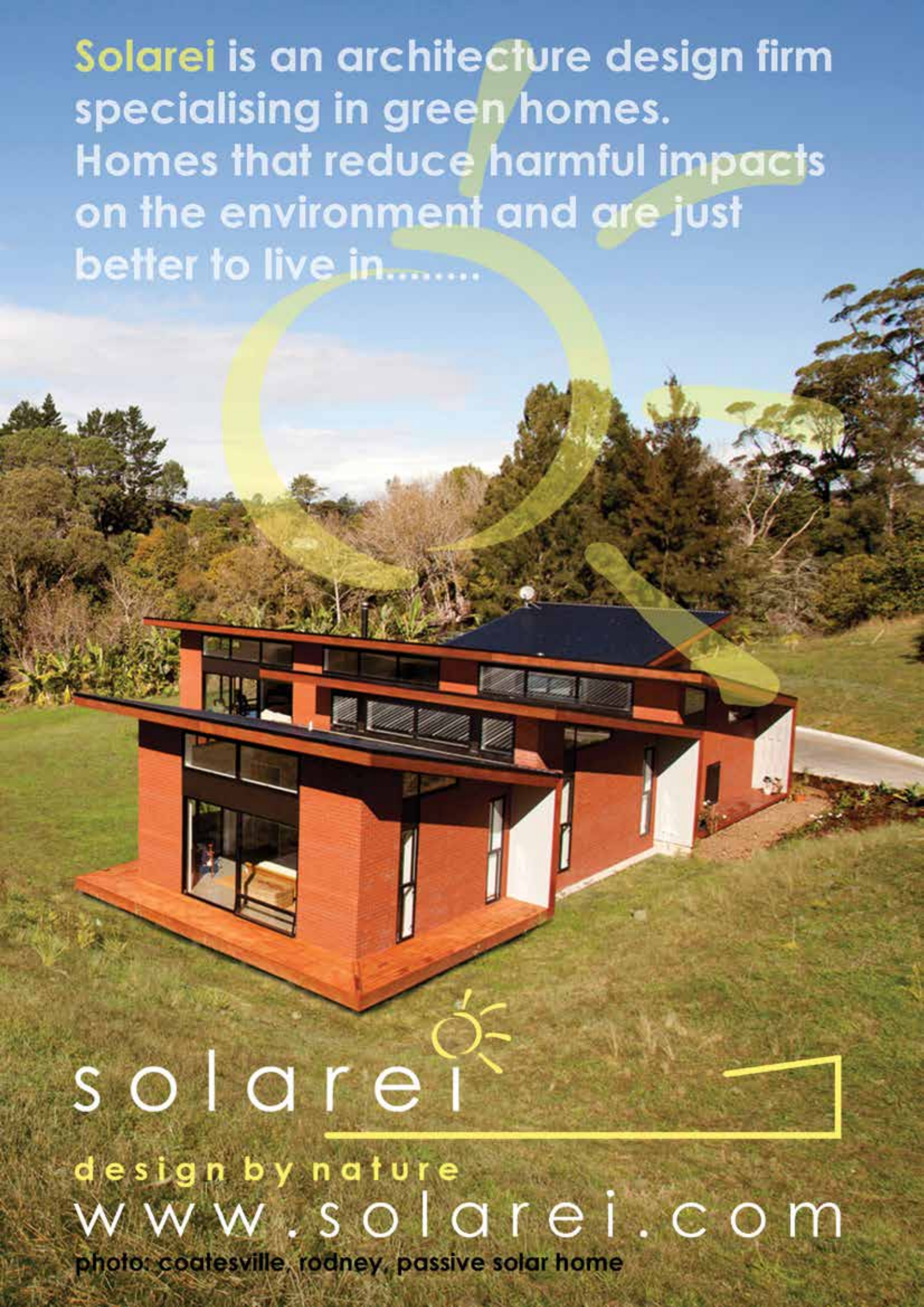
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