PASSIVE DESIGN

Included in this fact sheet:
- Orientation
- Zoning
- Thermal Mass
- Insulation
- Ventilation
- Shading
- Glazing

Passive design means using the forces of nature and the laws of physics to provide warming in winter, and cooling in summer.

The Sustainable Lifestyle House uses passive solar heating in winter, where the sun is allowed to heat the house, and the house then retains that heat. In summer, it uses passive cooling (note the absence of solar) to keep the heat out.

Passive design has six functional elements, and a seventh linking element, which must be applied differently to different sites. In the Sustainable Lifestyle House, these been applied in the following ways:

1. Orientation
The long axis of the lot is west facing, however the living areas face north, even with the separation between them. This allows major glazing to catch winter sun, yet be shaded from summer sun. Minor windows face west to pick up whisps of afternoon sun and allow views to the hills beyond. Being a corner lot also means the aspect of the house should address both streets to some extent. East facing windows are mostly shaded by the higher house next door.

2. Zoning
The internal floorplan provides separate living areas zoned off from each other, allowing control of heating and noise. This makes the house more liveable than if all living areas were open to each other. Open plan spaces should be no more than 50m², and separated by a door, as with this house. The air lock to the south facing entry also allows people to enter and leave without opening warm spaces directly to the outside.

3. Thermal mass
The ‘warming and cooling battery’ is located in the slab floor and the insulated internal skin of bricks in the living area walls. This takes in winter solar heat for use in the evening, and soaks up summer heat for release overnight. The house is well insulated to prevent heat leakage. The north facing living areas have the benefit of the slab floor and the brick walls that are exposed to direct and indirect solar gain.
4. Insulation
The building envelope (floor, walls and roof) must not allow uncontrolled heat flows in or out. High R-value insulation and low-E double glazing ensure this is achieved. Roofs and ceilings together are R5.6. Brick walls in the living areas are R1.9, which when combined with the dynamics of the thermal mass in the bricks makes them very effective. Walls in the southern bedrooms would get less advantage from having mass, so they are lightweight with high R3.0 insulation levels, to resist heat loss.

5. Ventilation
The floor plan and internal openings allow complete cross ventilation to occur when it is appropriate. This allows ‘night purging’ of summer heat. Draught sealing to doors and windows is critical too. Rogue draughts from exhaust fans etc have been controlled by using fans with self-closing blades.

6. Shading
Control of solar access is through fixed eaves and the pergola to the north. The pergola may have a deciduous vine or active roller blinds added in future. The seasonal shade sails to the west are removed in winter to allow full solar heat gain. West facing windows are small in area, and have shading overhead till late in the afternoon.

7. Glazing
This is the linking element mentioned above. Glazing links all of the functional elements above. That is, the orientation depends upon having north facing glass; zoning requires doors; thermal mass without glass is just a heat sink; glazing must also act as insulation; windows and doors allow ventilation; shading and glazing must be in balance or the solar access will be wrong – too much or too little.

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