Central Gippsland Health Service
Evelyn Wilson Home Residential Aged Care

Environmentally Sustainable Building

Quick Fact File

Project Manager / Owner Rep – Bruno Kappenberger, CGHS

Architect – Serdar Baycan, Tectura

Engineering Consultant – Philip Barnes, AHW

Cost Consultant – Steve Grimes, Plan Cost

Cost $5.5 million

- Mixed mode natural ventilation
- Natural lighting
- In floor hydronic heating
- Geothermal cooling
- Geothermal air conditioning
- Solar hot water boosters
- Reverse brick veneer construction
- Double glazing to south windows
- Rainwater harvesting

The Evelyn Wilson Home is a showcase Ecologically Sustainable Development funded by the Department of Human Services Victoria. The 50 bed nursing home incorporates both active and passive energy systems as well as geothermal energy and rainwater harvesting.

The principles of 'reduce, re-use, recycle' form a framework for the design, construction and operation of this facility. The Sale region enjoys a relatively high average number of direct- sunlight hours per year, in the vicinity of 6.5 hours per day. This presents an opportunity to take advantage of the energy of the sun, through effective building orientation and passive 'solar gain'. The reverse brick veneer system external walls and the concrete floor slab construction utilised here provide the thermal mass for this building. The advantages of reverse brick veneer are:

- Thermal mass is protected from external changes
- Thermal mass is inside, next to you
- Thermal mass regulates indoor temperatures throughout the year

The heat of direct winter sunlight is absorbed by the thermal mass in the walls and floor of the building. This mass allows heat to reradiate to even out lower night-time temperatures. Most types of masonry have excellent thermal mass and can be used. Alternatively, during summer the thermal mass assists cooling by resisting sharp increases in temperature.

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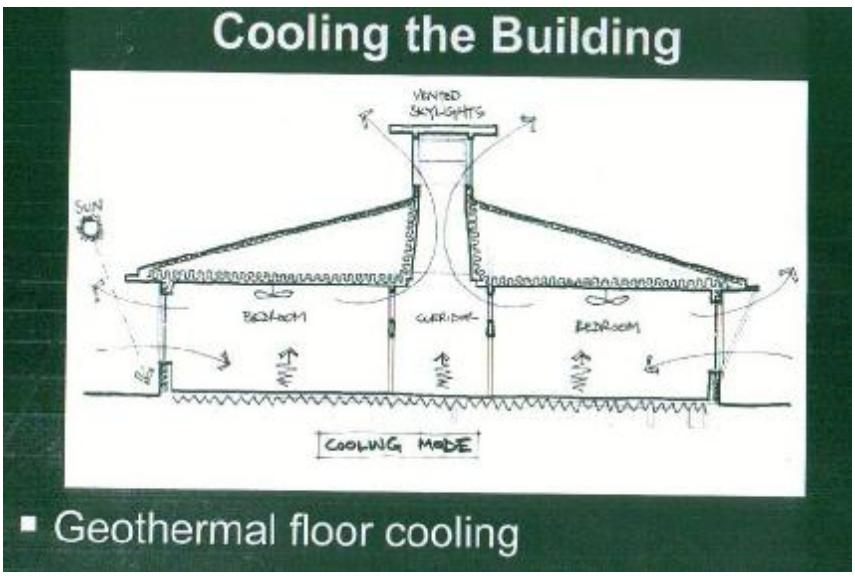
Natural ventilation, solar orientation and control, thermal mass reverse brick veneer construction and the geothermal systems are interdependent and most effective when working together.

Climate Data

Assiduous use of climate data is vital in determining the most appropriate design of the building envelope. Cool, temperate conditions prevail in the area despite almost one month of summer days with maximum temperatures over 30°C. The building requires heating for a far greater proportion of the year than cooling. Using the sun in tandem with the geothermal system on site reduces the energy consumption when compared with traditional mechanically heated and cooled buildings. Likewise, careful sun shading is of utmost importance as the cooling requirements of buildings expend vast amounts of energy, increasing operational and environmental costs. The correct shading angle, which allows winter light to enter windows and 'blocks' hot summer sun, resists unwanted heat gain and reduces heat loss during winter. Sunshades over western windows and double glazing to the south facade are integral to this outcome.



To maximise solar gain, the building is stretched in an East-West direction as this exposes more of the building to direct North sunlight. From an operational point of view, however, a long straight facility will increase travel distances and create problems with the positioning of shared utility rooms. The most efficient solution was to form a balance between operational and climatic factors which has been incorporated into the design of the facility.

Provision for operable windows to all bedrooms and lounge areas allows the benefit of natural ventilation and fresh air to supplement the passive heating and cooling systems. Breezes from the nearby Guthridge Lake and Botanical Gardens can be directed through the heart of the building to expel odours and stale air.

Mixed Mode/ Natural Ventilation

Mixed mode ventilation consists of air conditioning controls that allow shutdown of mechanical plant in conjunction with the activation of natural ventilation. The air conditioning is only run when natural ventilation is outside an acceptable range. Significant energy savings are achieved through this approach. The building benefits from increased occupant comfort and improved environment when natural ventilation is available but does not suffer when conditions are beyond these limits. Potential problems with sick building syndrome are largely overcome by using natural ventilation.

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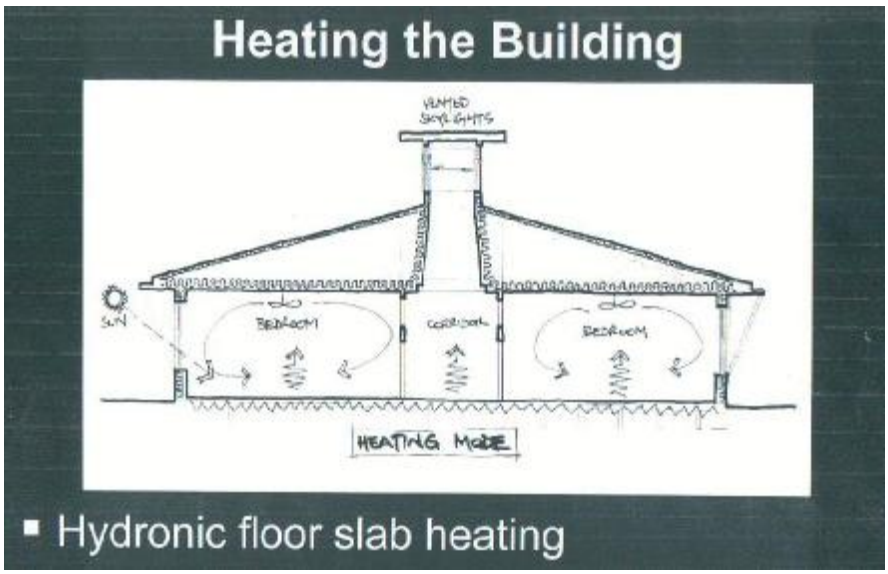
Geothermal Floor Cooling (In-slab)

The Sale area sits above the Latrobe Aquifer, a large body of relatively cool ground water. This water is used in a closed loop arrangement to utilise the aquifer energy without affecting the aquifer levels. Water is drawn from the aquifer for use in direct slab cooling and water source air conditioning. When used as a direct cooling source in a floor reticulation, the water supply provides a background level of cooling sufficient to significantly reduce air conditioning requirements. The floor reticulation system effectively allows almost free cooling to all areas of the facility. Sufficient cooling can be provided to resident areas of the facility. This cooling method compliments the natural ventilation and enhances comfort levels.

Solar Hot Water

Refrigerant based solar hot water panels and storage provide boost to the domestic hot water system to substantially reducing energy consumption.



Geothermal Air Conditioning

The same water supply used for slab cooling is used to provide heat rejection to heat pumps supplying air conditioning to the central common areas. The cooling is provided using heat pumps and ground water heat rejection and replaces air cooled air conditioning units. Noisy external condensing units are not required.

Rainfall in the central Gippsland region varies between localities, with over 600mm annual rainfall in the Sale district. One year's rainfall harvested from the roof of the new facility and collected in tanks, exceeds 1.3 million litres (1,320 cubic metres, based on a total building area of 2200m^2). The tank water is filtered and used as the primary potable water supply for the nursing home in lieu of town water.

The stored water has strategic benefits by ensuring security of water supply as general water for the unit rather than just a backup supply.

Water usage within the facility is restricted by flow control devices and the careful selection of fittings, such as low flow toilet pans and tap ware with in- built flow reducing capacity. Kitchen and laundries appliances have been selected for their energy and water saving abilities. Fixed appliances including lighting and hot water systems also received extensive evaluation.

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Socio-Economic Benefit Analysis

The Investment Evaluation criteria for DHS funded health projects provide a weighting for the socio-economic benefits of a proposal. The principal consultant team excluded this from the NPV calculations in order to demonstrate that the ESD systems proposed are appropriate even when they are analysed solely on economic criteria.

The use of controlled natural systems are of a significant socio-economic benefit for resident comfort (and the community) using ESD systems in this building

Economic Evaluation – Net Present Value Calculations (NPV)

Some of the options cannot be financially assessed independent of each other. For example, the supplementary air conditioning is dependent upon the hydronic heating and reverse brick veneer options.

Therefore, these need to be considered as a group rather than independently of each other.

The recurrent cost savings are based on current energy costs. It should be acknowledged that these will increase over the life of the building, making the financial benefits of the ESD options even more viable.

The list of ESD options NPV does not include is rainwater utilisation as the recurrent cost savings are insufficient to justify this option on purely economic terms.

ESD OPTIONS	Capital $ TEC	Recurrent Savings PA	Simple Payback
Mixed mode / natural ventilation including vents to bedrooms	$25,000	incl below	incl below
Natural lighting integration	$9,375	$1,850	5 years
In-floor hydronic heating including screed	$37,800	$900	42 years
Geothermic floor cooling	$6,875	$1,900	4 years
Geothermal air conditioning	$3,125	$600	5 years
Delete supplementary air conditioning to bedrooms	-$86,000	$1,500	na
Water flow control	$3,750	$600	6 years
Solar hot water	$2,500	$350	7 years
Reverse brick veneer construction	$72,000	incl above	incl above
Double glazing to south windows	$7,950	incl above	incl above
TOTAL ESD OPTIONS	$82,375	$7,700	
FINANCIAL ASSESSMENT CRITERIA			
Net Present Value			$26065
NPV/Capital Costs			34
Benefit-Cost Ratio			-1.25
Internal Rate of Return			11.35%

Acknowledgements
Serdar Baycan of Tectura and Philip Barnes of AHW for permission to use material from the report Central Gippsland Health Service, Evelyn Wilson Home, Residential Aged Care Development - Environmentally Sustainable Design Options – 26 October 2001
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