Renewable Energy and Environmentally Sustainable Design

Case Studies

Lumen Christi Primary School Hall

Site: Churchill, Central Gippsland, Victoria

Dates:
- Design Phase Commencement: September 2003
- System Commissioning: March 2005

Client: Lumen Christi Primary School

Project Goals:
To design and build a highly energy and water efficient and sustainable school hall, not reliant on conventional mechanical air conditioning. To demonstrate a series of solar technologies to students on a prominent eave structure.

Project Features:
A building with an impressive list of Environmentally Sustainable Design (ESD) features; the new school hall is a far cry from the original lightweight, energy intensive design.

Reverse Brick Veneer: A wall construction technique where the brickwork is on the inside and the timber framing and weatherproof membrane is on the outside with substantial insulation in between By placing the thermal mass on the inside of the building, with a high degree of insulation, the favourable thermal performance of bricks is utilised most effectively.

Window Orientation and Size: All windows were brought around to the north side of the building, and the size optimised according to the floor area. This allows good net heat gains in winter. Summer heat gain is impeded by a solar eave. Low-e type glass was used to retain the maximum amount of heat in winter. Drapes were adopted instead of double-glazing (which was expensive at the time).

Solar Eave: An eave was constructed on the north face of the building that provides total shading of the windows in summer, while allowing winter sun, which is lower in the sky, to passively heat the building. Mounted on the eave is a 1.9 kWp grid interactive photovoltaic system and four air heating/cooling systems. A two panel solar hot water system also originally proposed for the eave was mounted on the roof.

Solar Air Moderating System: The Sun Lizard system provides solar winter heating and air circulation (which reduces air stratification in winter) and removes heat in summer. To achieve the required level of heating and air extraction, four Sun Lizards were manifolded via a common register inside the hall.

Reverse Brick Veneer and the Solar Eave – Note the shadow on 25th Dec.

North-facing windows

The PV panels on the eave

The Sun Lizards on the eave

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A special control unit was designed to operate all four units, which were connected to a single 160W PV module to power electronics and circulating fans – i.e. no mains electricity is required to power the system.

Subsurface Water Storage System: A rainwater catchment tank was installed underground using the Rainstore3 system and performs a number of functions. Rainwater is captured from the 300m^2 roof area and run to the 20,000L underground cavity via a sediment filter. The water is utilised in toilets in the new hall and for watering of the gardens. At the lowest point of the Rainstore3 structure, pipes were installed through which air is pre-cooled and introduced into the tuckshop and meeting room in the building during summer. This system works in conjunction with the Sun Lizards, extracting heat from the hall with air introduced to the inlet pipes from a shaded garden area on the south side of the building.

Insulation and Heat Transfer: A very high level of insulation has been used in the new hall, including insulation of the roof, walls and slab edge. The new hall is connected to an existing library, which overheats in summer and is overheated in winter. The new building is designed to capture and reuse or extract the heat generated in the library through vents that connect the two buildings.

Landscaping: Vegetation was recommended to help moderate the micro-climate. Trees act as wind and sun protection; vines on the exterior walls provide an external layer of insulation. The students were encouraged to culture and maintain the vines, watch them grow and be involved with the project.

>>>> Also a Sustainability Victoria Case Study.

Project Team:

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The finished building (the vines are starting to grow)

Observation window for the underground water storage

Installing the Rainstore system

The 'cool garden' & air intake pipes

Slab-edge insulation

Foil and bulk roof insulation