

# An Earth Sheltered House in the Cotswolds, England

The experimental house looks out from sloping ground. It is a family project, led by Malcolm Cole's architect daughter, initially designed as a two bedroom, low maintenance, low running cost, retirement house for her parents. It started as an earth sheltered house where only the south face was open to the elements. During several redesigns we added a water-filled heat sink, ie swimming pool, and two further bedrooms turning it into a full sized family home.



After excavating the plot and drilling two boreholes for heat extraction, a reinforced concrete foundation raft was laid, supporting the walls and flat roof, also of reinforced concrete. The structure was waterproofed and the earth replaced above and around the house on three sides. This was topped with a multi layer insulating and waterproofing umbrella spreading out 3 metres beyond the house to trap heat within the



dry earth around the building. Finally the topsoil was replaced ready for our planned three layer forest garden above and behind the house.

This enormous heat sink should be capable of storing all the solar energy that enters the building. The theory says our low-e glass in south facing windows admits the high frequency solar energy, which gets converted to low frequency energy when it bounces off floors and walls, and thereafter cannot pass back through the glass.

Before construction started we calculated the incoming energy received on average each month and estimated that an additional 6KW of supplementary heat supplied by a 1.5KW ICE Energy heat pump, would be sufficient to heat hot water and house, leaving some spare to heat the pool.

It is very much an experimental building with each area having its own temperature characteristics. I measure the daily maximum and minimum temperatures at selected points in the house. It is still early days but the results show that the daily maximum temperatures are closely related to the amount of sunlight received.

We have had little chance to charge up our heat sink as the house is still drying out. So this first winter has stretched the capability of the heat pump, as it switches between providing hot water and house heating. Even so, on the coldest days with outside temperatures below freezing, the house only loses 0.1°C in 24 hours and overall the heat pump has maintained temperatures at about 20°C throughout the house.



The behaviour of the four rooflights was unexpected as they appear to behave just like any conservatory, losing heat rapidly as temperatures drop, and rising just as rapidly when the sun comes out. Our temporary solution this 2004-5 winter has been to fit insulated wooden shutters in each well.



I am starting to use our Skye sensor for recording the amount of free energy potentially available from the sun. This is adding another dimension to the analysis of the performance of this house, as I calculate the energy received through the glass and compare it with the recorded temperatures.

There is still a lot of work to be done with plumbing and decorating inside, the priority this year has to be getting the garden organised above and around the house to provide a mature setting in 2006.

*Thanks to Malcolm Cole for sending us this case study*

## The Equipment

In this application the Skye Pyranometer and hand-held display meter were used. Skye light sensors can be supplied wire-ended for use with recording equipment from other manufacturers, or with a Skye hand-held meter, datalogger or NEW SpectroSense2 meter. Skye light sensors are individually calibrated and all calibrations are traceable to National Standards.

*Further details can be found on our website at [www.skyeinstruments.com](http://www.skyeinstruments.com)*

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