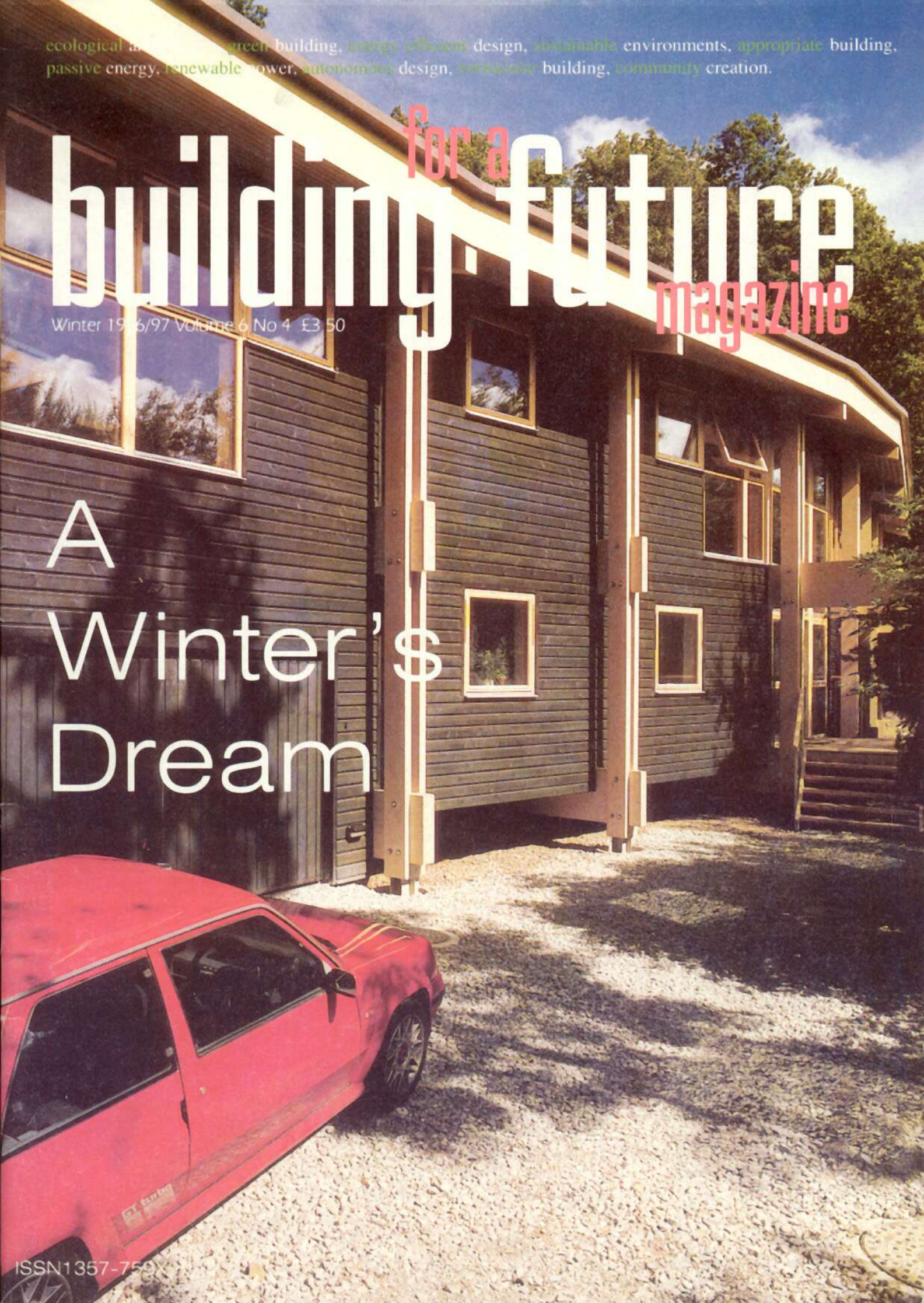
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A Winter's Dream
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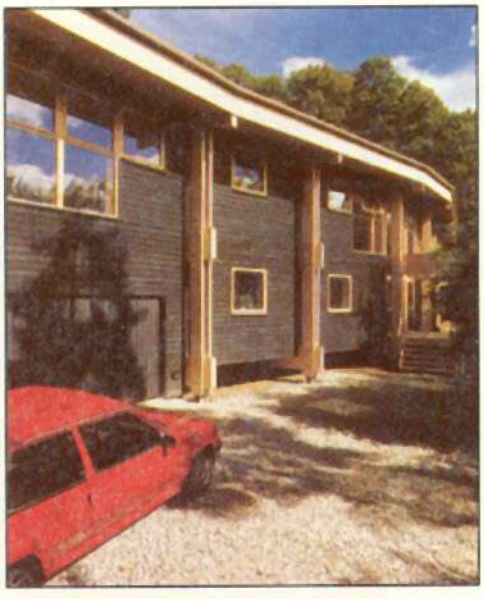
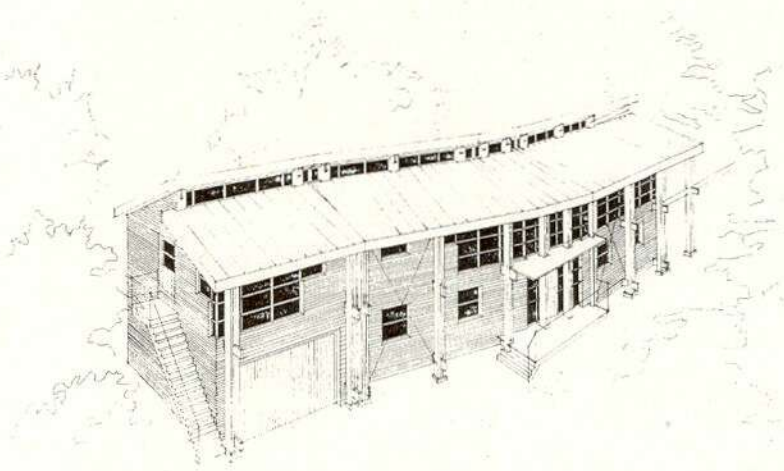
A Winter's Dream

Architect and AECB member Michael Winter, together with his partner Elizabeth Monk, an accountant, have completed their experimental, low energy and low environmental impact house. The 3,250 square feet, timber-framed house is in Tunbridge Wells and is built on a secluded, half acre, woodland site. The couple's aims were to work with, rather than against the surroundings, and to retain as many of the trees as possible (only three had to be felled). They wanted the project to be as 'green' as possible but whilst the preference was for ecologically acceptable materials, cost was also a factor for consideration. Michael wanted the best materials in terms of both price and availability. He tried to take into account three points in his selection of materials; the manufacturing process; material used and transport involved. The latter, he found was the most difficult.



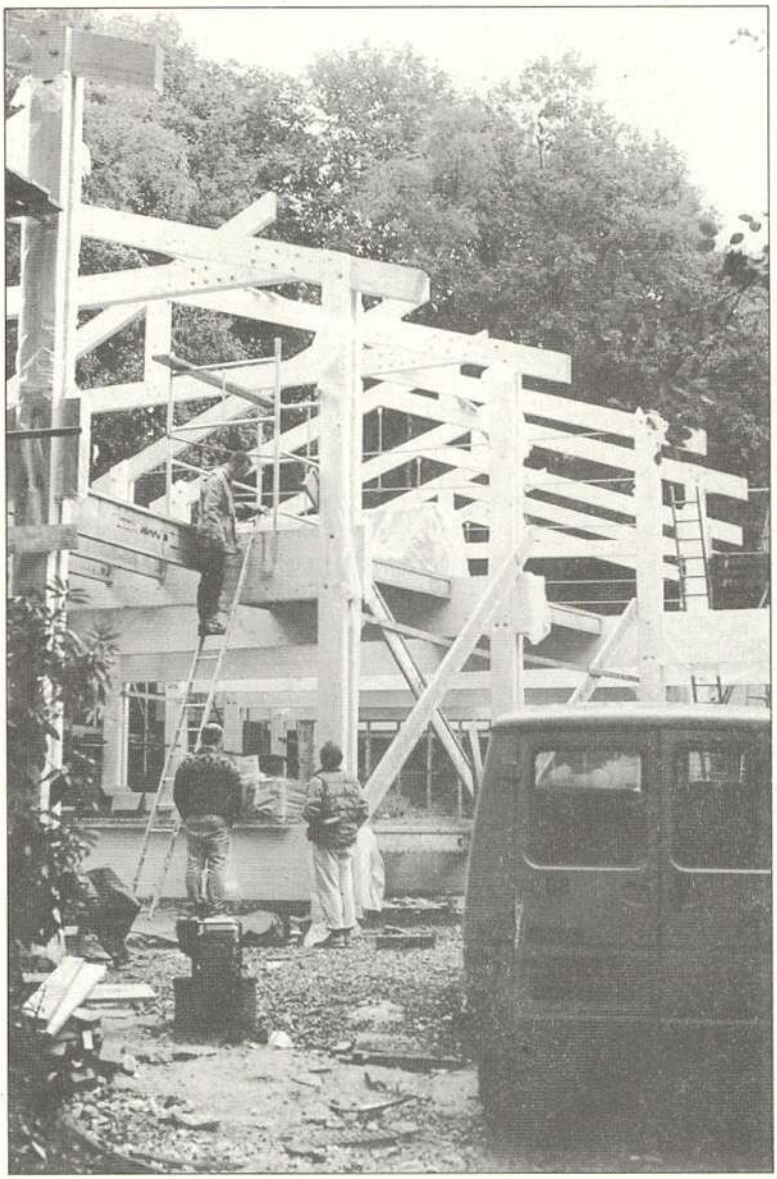


A pay back period of 10 years was the target for the energy and water systems. The house is designed to be a modern home, rather than a showcase for environmental purists and this is apparent as it is a large house with four bedrooms and three bathrooms (two en-suite) which may bring comment from some. The size of the house and number of bathrooms, Michael explained, was considered desirable and is apparently standard for the surrounding area and a consideration for marketing if the property was ever sold.

The house has recently won the Daily Telegraph's Individual Homes Builder of the Year Award - and a week's holiday for two in Venice for Michael and Elizabeth in a converted 14th century palace hotel! It won the most energy efficient house category and was unanimously voted the best contemporary house by the judges. The Award aims to provide recognition and encouragement for people who are not satisfied with mass-produced houses. The judging criteria included design; quality of finish; value for money; and special considerations (innovation in design and specifications).

The house is said to have a slightly Japanese look with its laminated wood beams arranged in pairs to support the roof and sturdy cross members. It is carefully sited to maximise solar gain and light. It faces south and the south side is open with lots of triple glazed windows to trap the heat. In the summer the large overhang and leaves from the trees provide shelter from the heat. In winter when the trees have lost their leaves and the sun is lower in the sky, its rays can penetrate the house. The back of the house faces north and has therefore been built of a solid construction. There is a single wood-burning stove, for cold days, in the centre of the open plan living area and electric towel rails in the bathroom.

The design is for a light and airy feel. In addition to the three bathrooms there are four bedrooms, a living area, a laundry room, a separate open plan office/studio area and spacious, covered deck on the east elevation. There is a larder on the north side of the house with vents.The internal room layout helps to keep energy use to a minimum, with service rooms such as the bathrooms on the north and bedrooms on the warmer south side. There are floor to ceiling windows on the south facing side of the main living area and hardly any windows on the colder north side. The house has been designed with an 'upside down' layout, ie the living spaces on the first floor are above the bedrooms located on the ground floor. This utilises the natural movement of warm air rising above cold and allows the living spaces to be a few degrees warmer than the bed-



Massive glulam posts, beams and trusses form the main structure of the building whilst composite joists carry the internal and external skins.

rooms. Given the height of the surrounding trees, the main living, dining and kitchen areas are all on the upper floor with the bedrooms located on the secluded privacy of the ground floor.

Conventional foundations were not used as the couple wanted to retain the maximum number of trees. Instead the timber framed building was raised up off the ground and supported by deep pad foundations (1-2m deep) to ensure minimal environmental impact and the retention of most of the trees on the site. Concrete pads placed between the tree roots support the legs of the timber frame. The house is actually built around the trees and is therefore crooked. The visible structural beams are glue-laminated. Michael developed the timber-frame building system himself, with the help of TRADA who have recently completed a report on the project. It is based on the traditional post and beam building system but replacing the oak with glue laminated timber beams and the joints are stainless steel bolts. The strength of glulam beams enable wider spans and more flexible open-plan design possibilities. The house comprises of 16 huge vertical glulam beams about eight metres long, supported on the concrete pad foundations, with horizontal glulams bolted across them to form the two floors and roof structure. The glulam structure incorporates steel rods to tie the framework together, which like the steel bolts, have been used as a feature of the house.

Above: south facing glazing and clerestory windows with large overhangs to prevent overheating in the summer
Far right:: the open plan living space is dominated by the central wood burning stove

U Values (w/m²K)	
floors	*0.144*
windows	*1.4*
walls	*0.139*
roofs (south)	*0.087*
(north)	*0.078*

The structure of the walls and floors between the glulam skeleton uses timber 'I' beams (manufactured in Canada by Truss Joist Macmillan from laminated wood sections) positioned at 600mm centres. These 'I' beams have the strength of solid studs of the same dimension, but contain less timber, prevent any possible cold bridging of heat from inside to outside and are less prone to warping.

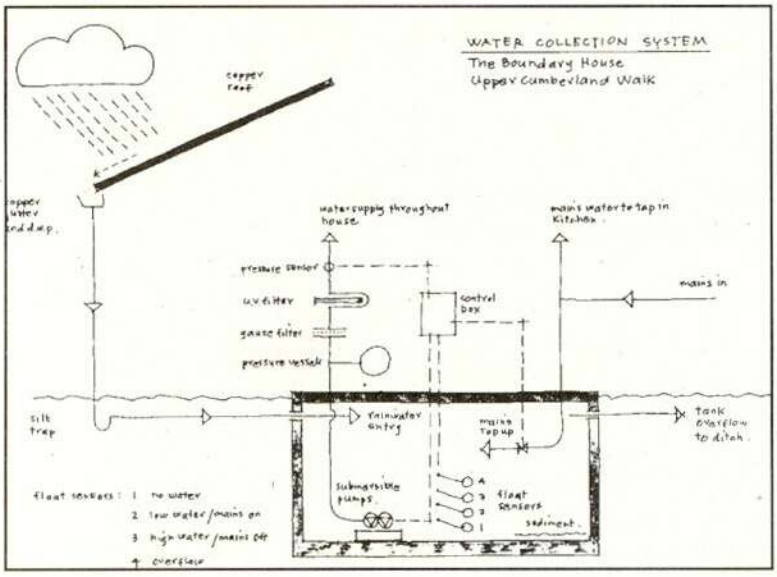
The windows are supplied by the Swedish Window Company and are triple glazed with low-E glass and the voids filled with argon gas. The insulation factor is more than twice that of double glazing. The windows have Scandinavian, softwood frames and the total cost around £15,000.

The exterior of the house is clad in softwood timber boarding imported from Scandinavia, stained black. Both the boarding and the exposed glulam timber frame are stained using Ostermann and Scheiwe stains. The roof, walls and floor are very well insulated to avoid central heating. The walls use the 'breathing wall' system developed at Findhorn in Scotland. This system uses Warmcel cellulose fibre (250mm in the walls and floors, 400mm in the south roof and 450mm in the north roof) treated, as standard, with borax for fire and vermin protection, blown into the cavity in the walls, between bitumen impregnated fibreboard on the outside and a vapour control barrier/plasterboard on the inside. The vapour control layer provides a check on the amount of moisture passing through the construction, thereby avoiding potential rot problems.

The close proximity of the railway and the need to reduce noise entry into the house was the deciding factor in opting for a mechanical ventilation system. The system was supplied by Genvex and is powered by two 75 watt electric fans, to bring fresh air in and expel smells and condensation. This is connected to a combined heat exchanger and heat pump so that the incoming fresh air is warmed from the waste heat collected from the kitchen and 3 bathrooms. The heat loss should be around 15%. The heat pump is basically the reverse of a normal domestic condensing refrigerator or freezer, an electric motor propelling a volatile coolant but with the heat collected and put into the incoming fresh air. The idea is that they recycle considerably more energy than they use.

The building is being monitored for twelve months by the University of East London, School of Architecture. In December 1996 the couple found that with an outside temperature of -5 degrees centigrade, the internal temperature, with no heating other than the heat extraction system operating, was 12 degrees centigrade, which is lower than anticipated. It is also proving difficult to keep the wood burning stove alight through the night, although it is anticipated that this is only a teething problem as the couple learn to live inside their new home.

All the timber used is softwood and the wooden floors inside are second-hand, reclaimed from a school in Dartford. Toxic substances like preservatives and solvents were avoided. Michael was well aware of the fact that providing timber is kept dry and well



ventilated it will not deteriorate and there is no need to use preservatives. Whilst the exterior of the building (which was completed first) is finished using organic stains, depleted funds resulted in using emulsion (water-based) paints for the finish internally. No gloss paints were used and Michael advised that he had researched the ingredients of all the internal coatings used and considered them to be acceptable with either very low or zero quantities of solvents and toxic additives.

The roof (Michael's original idea was to have a grass roof but his partner did not like this idea) is clad in copper which will turn green and blend well with the woodland. It was designed in two sections, the north section raised slightly above the south section to create a small clerestory to attract more sunlight. Rainwater collected from the roof is stored for household use. The rainwater pipes are also of copper which lead to the underground tank. This collects rainwater from the roof and purifies it for household use. Most of the water needed comes from this system but the house is attached to the main as a back up. Drinking water is currently from the mains because of the concrete/metallic taste of the collected rainwater but it is hoped that in the future drinking water too will be provided from the roof. Thermomax solar panels, costing around £2,500, clad the roof and heat the hot water needed, with electric immersion heating as a back up on cloudy days. It is anticipated that water heating bills will be cut by a third.

It is interesting to note that the house only scored 69 on the initial SAP energy-efficiency test and a rating of 7.2 on the NHER scheme because of the inability of the energy rating schemes to fully take into account the passive solar technologies used in the design. The figure has since been increased to a SAP rating of 82 and a NHER figure of 9.

Inevitably the house has received a lot of publicity and an open day arranged for 'inquisitive neighbours' attracted over 70 people.

The building was started in July 1995 and took about eight months to complete. The cost of the woodland building plot was £65,000 and the cost of building £235,000 (significantly more than originally anticipated) which equates to around £70 per square foot. The building costs were increased significantly because of the nature of the site, long connection runs and site access. Also the underground water storage tank (the whole water collection and storage system, including pumps and filters etc costs between none and ten thousand pounds to design, build and install) because it formed part of the garage to the foundations had to be built to high specification to conform with building regulations. The house also includes other higher than usual capital cost elements with a view to saving energy and money on running costs. The building work was subcontracted to a local joinery company and the project was managed by Michael and Elizabeth, Michael taking charge of the design and Elizabeth, the finances. The current value of the property is estimated at over £320,000.

Information on the use of composite beams such as those used in this house, is contained in the TRADA publication 'Structural Timber Composites', published in September 1996. Design principles are included in 'Energy Efficient Housing - A Timber Frame Approach'. Copies are available from Trada Technology Ltd. Tel. 01494 563091

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