Introduction to the Greenshop Group eco-building

The Greenshop Group of companies has been evolving and growing since the early 1990's and by 2002 our solar power, rainwater harvesting, natural paints and eco-store had started to out grow the existing buildings. The concept for the new Greenshop eco-build was to create an inspiring workplace and at the same time be totally sustainable.

Even in 2002 issues relating to climate change were not as high profile as today and sustainability policies not as well developed. We were still thought of as "alternative greenies" and so a design had to be developed that satisfied many of our design aspirations, whilst at the same time, was acceptable to planners, local people and the wider public.

It took three years before a building was conceived that would demonstrate innovative sustainable building practices and include many of our own sustainable products, as well as being acceptable to the local planning department. The building finally obtained planning permission in 2005. Construction commenced in late 2006 and completed in December 2007.

The Greenshop shares a site with Holbrook Garage, a busy rural garage near Bisley in Gloucestershire, with a petrol forecourt and workshop for MOT's and car sales.

Construction

The new building, between the existing Greenshop retail area and the garage workshops, is located on a the site of a old stone quarry. At the outset this gave problems regarding the foundations since the surface ground was infill. A secure foundation had to be established about three metres down on the slab rock and block walls constructed from this base up to ground level.

The building is timber framed and incorporates very high levels of insulation and air tightness. It is designed to make good use of passive solar heating and natural lighting. This is aided by a clerestory, a row of windows under the eaves on the south facing wall, which gets as much natural light as possible into all parts of the building.

Good insulation not only keeps out the winter cold but also helps keep the building cool in the summer. However additional measures are needed to protect against overheating. These include large overhanging eaves to reduce the penetration of summer sun into interior spaces and living roofs on the south side to help absorb heat, as well as passive night time ventilation that introduces cool fresh air into the building overnight.

To weatherproof the outside of the building the upper walls are clad in local douglas fir and the lower walls are rendered with lime. The north roof is steel profile to provide good run-off for rainwater harvesting and the main south roof is a 'green roof' planted with sedum. The entrance canopy and the two link blocks, tying the new building with existing buildings, have 'brown roofs' covered with impoverished soil, stones and logs from the site. Their function is to create a storm-water absorbing wildlife habit that is interesting to observe at all times of the year. Further wildlife friendly features include a number of bird and bat boxes and a pond near the main entrance.

Building Materials

Choice of sustainable building materials is important in order to reduce the embodied energy of construction. Concrete is very energy intensive in its manufacture and is only used in the ground floor slab which has a post and beam construction to keep concrete use to an absolute minimum.

The main building material throughout is timber, from sustainable sources, which locks up carbon absorbed during tree growth for the lifetime of the building. External render uses lime which is breathable and has much lower embodied energy than similar cement based products. The exterior walls and roof are filled with Warmcel insulation made from recycled and pulped paper. Interior insulation is sheep's wool from Thermafleece which serves the dual function of sound and heat proofing different areas of the building.

Energy Efficiency

The strategy is to minimise energy use for heating by using high levels of insulation and making the building as airtight as possible. As a result all heat requirements are met from solar and waste wood. Energy efficiency is reinforced by the behaviour of the building occupants through raising awareness of how energy is used and potentially wasted.

The building is technically a 'light weight construction' with additional thermal mass from screed in the floors and double layers of plasterboard in selected walls. This helps maintain a more stable internal temperature, storing warmth in winter, absorbing heat on summer days and releasing it at night. Without thermal mass the internal temperature of a light weight building is closely linked to the external temperature which can increase the energy needed for heating and cooling, as well as reducing the comfort of occupants.

Ventilation throughout the building is achieved passively with no mechanical or energy inputs. Summer ventilation and night time cooling uses secure window-like vents which can be left open over night. The open void between the ground floor and first floor is designed to exploit passive ventilation principles. It enable cool air entering via ground floor vents to flow upwards through the building absorbing daytime warmth and exiting through the open clerestory windows.

Zero Carbon Heating

Heating is supplied via under-floor heating and a sophisticated control system. The is very efficient and runs at much lower temperature than conventional radiators in order to make best use of solar input. The under-floor heating is fed from a Consolar thermal store, which in turn is supplied from Consolar solar thermal collectors and a Froeling log boiler.

Solar thermal collectors are fitted vertically on south and east facing walls to maximise solar input in winter when heating is required and reduce input in summer when we only need hot water. A log boiler was chosen to enable us to burn logs from managing our three acre site and waste wood from old pallets and crates used for deliveries to our businesses.

Despite energy efficient lighting there is no way around using electricity, mainly for office computer systems. Since we are almost 1000ft above sea level on the edge of the Cotswolds we had planned to generate electricity with an on site wind turbine but this had to be withdrawn after discussions with the local planning authority. However a good contribution to our electricity use is made by a 4.6kW solar PV system on the south facing roofs.

Fixtures and Fittings

Internally the floors are natural wood. First floor offices have oak boards and bamboo is used on the ground floor showrooms and visitor areas. The ground floor warehouse is screed, with marmoleum in the offices. The main entrance matting is made from recycled car tyres. All wood, internally and externally, is treated with Auro finishes and walls throughout are painted with Auro paints.

The toilet ventilation conserves energy by using a system called Airflush. Instead of taking warm air out of the room with an overhead extraction fan, Airflush extracts the a much smaller volume of air directly from the source of the problem, under the rim of the pan.

Water use on site is mainly for toilet flushing and this is minimised by the use of rainwater harvesting systems and water efficient appliances, including low flush toilets, waterless urinals and water efficient taps. Rainwater is collected from the north roof of the building, filtered and stored for reuse in an underground tank. It is pumped on demand to the point of use.

During day time the inside of the building is flooded with natural light. When required high efficiency, low energy, T5 lighting gives the feeling of bright welcoming spaces whilst minimising energy use.

Technical Specs

U values:	$W/m^{2/}K$
Walls:	0.12
Roofs:	0.09
Windows and doors:	1.1
Air tightness:	2.8 $m^3/hr/m^2$