National Trust

Sustainable technology case study

- building listed as Grade I
- roof replacement project
- Filsol (FS20) solar thermal collectors
- serving two flats and two holiday lets

Solar thermal

Installation of solar thermal units to provide hot water to flats

January 2010

Background

■ Hanbury Hall is a beautiful William and Mary-style house built in 1701 for Thomas Vernon. Surrounding the house are twenty acres of recreated early eighteenth century gardens and 400 acres of parkland.

■ The Hall has a flat lead roof, which had last been restored in the 1960s. At the time bitumen felt was placed between the lead and the roof, this had since stuck in place during periods of high temperatures. This prevented the lead from expanding and contracting over the boards, ultimately causing weaknesses and cracking.

■ The roof had been given many patches and temporary repairs; however its condition had begun to pose a serious threat to the contents and painted interiors of the house. In addition there was a constant ingress of water into the two staff flats and two holiday flats on the top floor.

The project

■ As part of the wider project to replace the lead roof on the main building at Hanbury Hall, it was decided to install a solar thermal system, to provide hot water to the four flats on the top floor. As the lead roof was due to be taken up, this was seen as an ideal time to install the panels, as pipes would need to be laid under the lead. In normal circumstances this would have caused a great deal of additional work.

■ Until recently, oil-fired boilers and portable electric heaters had been used to maintain the correct heat levels within the house. In addition, the flats all relied on electric storage heaters to provide both heating and hot water.

■ The intention was to deliver a new source of hot water to the flats on the top floor using renewable energy and without adversely affecting the Grade I listed building.

■ Four separate systems were proposed. These would use solar thermal collectors to produce hot water for each flat individually.

■ Previously, immersion heaters were used in the flats to provide hot water. The aim was to use solar thermal collectors in conjunction with boost heaters to top up hot water levels at times of low solar radiation.

■ A consultant was commissioned to design the specialist system for the National Trust.

Far left **Hanbury Hall during the re-roofing works**

Left **Solar thermal tank**

Design

■ It was proposed to locate four sets of solar collectors towards the north-west corner of the main roof. The flat nature of the mansion's roof presented design challenges for the installation of the panels. The location had to be carefully selected to minimise any visual interruption of the principal sight lines of the building; with particular emphasis being given to the south elevation, this being the main approach.

■ During preliminary investigations to assess the visual intrusion that the installation might create, a number of coloured buckets and mock-up timbers were placed on the roof in the north-west area. This location had been selected as it allowed most elements of the panels to be hidden by features of the roofscape, such as lead rolls, falls of lead bays and chimneys; whilst remaining the best position to offer the greatest efficiency from un-shaded sunlight.

■ A meeting was held to view the appearance of the mock-up devices from various positions within the park. The overall consensus was that the north-west area location on the roof was preferential, and that the effect of the proposed panels as seen from the park was negligible, being well distorted by the roof's natural features.

■ The mock-up timbers had been 295mm higher than the level of the lead bays, however it was later confirmed that by using 'bespoke' fixing brackets this dimension could be reduced to just 248mm.
The four units were ultimately grouped on the north side of the main ridge roll, taking advantage of the height of this roll, plus the fall of the leadwork to partially hide the installation. From ground level the appearance of the house has not noticeably altered.

■ The installation consists of four separate flat plate solar thermal systems. Each with two solar collectors, pipes, expansion vessels, a storage tank and Deltasol digital controls.
The systems were installed in two stages in order to accommodate holiday flat bookings and so as not to disturb guests.

■ The work was undertaken during the roof replacement project allowing access to the space under the roof for running pipes and connectors. The solar collectors were then installed as the lead roof was put back into place. This greatly minimised the additional work that could have been incurred.

Above **Deltasol digital controls**

Funding

■ The installation was 50% grant funded by the Low Carbon Buildings Programme (LCBP) who required the equipment installer to be accredited.

Carbon reduction

The carbon savings amount to between approximately 1700kg and 2600kg CO_2 per annum, based on the replacement of electricity heating with solar.

Review

Performance

■ Solar water heating systems use high efficiency solar collectors to absorb the sun's energy and heat a transfer fluid which circulates within the collector. The temperature of the fluid within the solar collector is monitored against the temperature of the water in the solar hot water cylinder. When the collectors are hotter than the cylinder, the controller switches on the system's circulating pump to circulate the fluid through the collectors and the cylinder's heat exchanger.

■ Based on independent evidence, Filsol collectors are proven to generate an average output of 450kWh per m^2 of collector per year.

■ The units at Hanbury Hall performed well after commissioning but produced lower levels of hot water than expected. This volume of water was not considered sufficient for day to day living in the flats. The immersion elements were removed from the tops of the cylinders and placed further down to enable larger volumes of water to be heated.

■ Generally the system has been easy to use and well received. Tenants in the flats and visitors staying in the holiday cottages have been happy with the running of the solar thermal system.

Review

Energy generation

■ It is hoped that the solar thermal system will supply 80% of the hot water for the two staff flats and two holiday lets on the top floor of the house. It is estimated that these flats use between 3,300kWh and 4,900kWh of electricity per annum. Therefore the new system could save as much as £1,600 per year.

■ Each system, consisting of two solar thermal panels produces about 5,200kWh.

Maintenance

■ An annual maintenance contract is in place.

■ Re-positioning the elements led to some problems with the system, these issues have since been rectified.

Engagement

■ The property remained open to visitors as usual during the roofing work. Visitors were able to observe works in progress from a viewing platform. This was enhanced by a short guided tour given by volunteers.

■ Whilst the re-roofing works were taking place, Hanbury Hall trialled presenting the house as though by night.

Associated works

■ A Victorian storage tank was re-used for the new rainwater harvesting system.

■ The roof space was insulated with hemp and with Tri-iso foil where space was limited.

■ During the re-roofing work an unexpected discovery was made, it appeared that the cupola was actually a dove cote; the original design of which has now been revealed.

Future plans

■ The property is currently reviewing various options for greenhouse heating.

Lessons learnt

■ Due to unforeseen circumstances, a new contractor had to be brought in part way through the project. In hindsight a lengthier handover would have helped reduce some of the challenges the new team faced.

■ It is important to carefully manage equipment selection and sizing (solar collectors and associated heating pipework/cylinder) with technical input where possible, to ensure the most appropriate scheme for a flat or tilted roofing arrangement. Back-up immersion positioning and sizing is another important consideration.

■ The installation of solar thermal collectors, hot water cylinders, pumps and so on is becoming more main stream; however, it is important to use experienced and suitably located contractors for the work.

Recommendations

■ Combining the installation with the replacement of the roof significantly reduced the work associated with mounting the solar collectors.

Further information

Architect Rodney Melville & Partners
Contractor Southern Solar

Above right **Solar thermal installation with the restored dovecote**

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