



National
Trust

Sustainable technology case study

- listed building (Grade I)
- micro-generation renewable energy
- award-winning LaZer2 solar collectors
- developed and manufactured in the UK



Solar thermal

Solar energy system to help with heating for the property
December 2009

The project

Nunnington Hall is a Grade I listed building situated on the bank of the River Rye, lying in the picturesque heart of Ryedale. The present building dates from the sixteenth and seventeenth centuries although parts of the property were substantially modernised in the 1920's.

Nunnington was one of the first National Trust mansions to undertake this kind of project. New solar thermal panels were designed to work in conjunction with the existing oil-fired boilers to provide heating for the building, even on cloudy days. This includes heat for the kitchens, staff flats and the visitors' toilets. It is hoped that the installation will dramatically reduce the Hall's heating oil consumption in the next few years as the Trust strives to reduce its reliance upon fossil fuels.

Energy saving measures such as low energy bulbs and monitoring of services (water, electricity, oil consumption) are also in place at Nunnington Hall.

Listed Building Consent was required for mounting the solar panels on the roof and for the installation running through parts of the mansion and staff accommodation.

There are bats resident in the roof space which could not be disturbed. A bat survey was commissioned to ensure that the resident bat colony remained intact without due disturbance.

A Type 2 Asbestos survey was carried out in September 2004 and asbestos material was discovered to the pipe lagging and on the ceiling of the boiler room. Records in the asbestos file retained at the property showed that an inspection had been carried out and asbestos material removed in March 2007. Another asbestos survey of the boiler room was commissioned. This indicated that there was still some asbestos debris present. An environmental clean of the boiler room took place and a satisfactory air certificate was obtained.

Design

The solar energy system at Nunnington Hall had to be installed with minimal intervention, to avoid impacting on the historic fabric of the building.

Works comprised of:

- fitting solar panels to the inner south facing roof
- installing distribution pipework
- a solar calorifier, pump and connections to the existing oil-fired boilers
- equipment for monitoring the solar panels
- a new purpose-built cupboard to house the cylinder

There are nine solar collectors (12.15m²) with 58mm diameter glass vacuum horizontal tubes. The collectors were fitted to the inner south sloping roof. This position maximises heat collection whilst being visually hidden from ground level. There is a roof access point from the building onto a lead valley gutter between pitched roofs, which offers a reasonable vantage point for monitoring and maintenance of the solar collectors.

The heat gained by the solar collectors warms up the temperature of the mains cold water that feeds into the two oil-fired boilers. This therefore reduces the output necessary by the boilers to heat the water to the required level.

A Structural Engineer was engaged to check the loadings imposed on the roof by the solar collectors, as well as loadings on the floor of the staff room, where the water cylinder is located.

Routes for the distribution pipework and positioning of equipment were carefully selected to minimise disturbance to the historic building fabric. The majority of the pipework is located in ancillary parts of the property that had been altered in the 1920's and later.



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In order to install the water cylinder into the staff room, it was necessary to have one of the vertical sash windows temporarily removed. This was carried out by experience joiners to avoid disturbance.

The design and installation of the solar energy system was undertaken by J Lister Electrical Ltd. of York. This company had become involved with solar energy systems approximately thirty years previously and had recently teamed up with SolarUK Ltd. to expand their business in Northern England.

Above **Nunnington Hall, south front**

Duration

- Bat survey and report: June – July 2009
- Asbestos survey and environmental cleaning of the boiler room: End September 2009
- Formation of holes through the structure for pipework installation; removal of staff room window and installation of hot water calorifier; fixing of solar collectors and slates works, including additional roof fixing battens: October – November 2009
- Completion and commissioning: December 2009

Below **Hot water cylinder (during installation). New tank cupboard installed**



Solar UK

Funding

- The project was funded by the Green Energy Fund. Npower in partnership with the National Trust.
- In financial terms, installation costs should be recovered long before the twenty five year guarantee expires.

Carbon reduction

The National Trust had a target in place to reduce oil consumption by 20% over the period 2006 to 2009.

As one of the largest energy consumers in the Yorkshire & North East area, Nunnington Hall had been specially targeted to reduce its oil consumption.

Using solar energy will help to offset the power required by the existing oil-fired boiler to provide hot water for the property.

Based on independent test results and historic climate data for York (assuming a daily hot water demand of 500 litres), it is estimated that the system will deliver a total of 4.73 mWh/annum and deliver 44% of the annual hot water requirement for the property. This comprises hot water for the public toilet wash basins, a fifty-cover tea room plus kitchen areas, servery and two staff flats.

The oil consumption for 2008 (heating and hot water for the mansion only) was 21,592 litres or 231 mWh. Assuming that the existing oil boiler system operates at an average efficiency of 70% (including metering inaccuracies and transmission losses) a total of 6.76 mWh will be replaced each year. This is equivalent to 632 litres of oil or 2.93% of total consumption based on 2008 figures. It is estimated that this system will reduce CO² emissions by 47,300 kg during its twenty five year operational life.

Review

Performance

■ Recent evidence (July 2011) suggests that the system is outperforming the initial design figures considerably (approximately 20%), based on the kWh being produced.

■ There have been no real issues with the solar energy installation, demonstrating how well the system was designed and installed by the contractor.

Energy saved

■ It is estimated that Nunnington Hall will make at least a 40% saving on water heating costs.

Maintenance

■ The system has a design life expectancy of twenty five years, with minimal servicing.

■ A two yearly service is recommended to replenish antifreeze and check the system.

Engagement

■ The mansion remained open to visitors whilst the system was fitted.

■ The solar collectors can be viewed through a window inside the property. Visitors are able to see how a micro-generation system can be effectively incorporated into a sensitive, historic Grade I listed building.

■ An interpretation display has been created to give visitors more information on the micro-generation system.

Review

Lessons learnt

■ “Anything is possible with the correct level of planning, preparation, co-ordination and high quality installation.” Steve Hammond of J Lister Electrical Ltd.

■ “The concept of installing a solar energy system to a Grade I listed building initially appeared an onerous task. However, with careful consideration to the historic fabric, support from the local Conservation Officer and excellent management and skills from all the contractors involved, the project has been highly successful and is resulting in a positive reduction in Nunnington’s oil consumption and energy KPI targets.” David Parker, National Trust Building Surveyor

Subsequent work

■ The monitoring equipment was upgraded in April 2011, so that clear readings of produced kWh energy could be observed and monitored.

Recommendations

■ The energy system and contractor are highly recommended. J Lister Electrical Ltd. (Solar UK) give honest free advice, carry out free surveys and offer high quality installation and an excellent after sales service.

Contact

Nature conservation advice John Drewett Ecology, Richmond

Contractor Design and installation by Steve Hammond for J Lister Electrical Ltd., York (Solar UK)

Structural engineers Gez Pegram, Alan Wood & Partners, York

Plumbing W E Hargrave Ltd, York

Joinery Houghtons of York

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Above **Distribution pipework from roof collectors to hot water cylinder**

If you require this information in alternative formats, please telephone **01793 817791** or email **buildingdesignguide@nationaltrust.org.uk**

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