



National  
Trust

## Sustainable technology case study

- 1,554 photovoltaic panels
- maximisation of day lighting
- carbon reduction
- Building Management System



Heelis, Wiltshire

© NTPL/James Dobson

# Photovoltaics

New build sustainability flagship office  
July 2005

# The project

The objective was to meet all the Trust's needs from a new Central office, while also contributing to the appropriate and sustainable development of this important historic site.

Sustainability is a key issue in the National Trust's philosophy and Heelis (the new office is named after one of the Trust's founder members Mrs Heelis, otherwise known as Beatrix Potter) had to meet high quality benchmarks for sustainable design.

The environmental operation of the building focused on three main areas: the maximisation of day lighting; reducing energy use; and thermal performance.

The National Trust's brief to the architects was to consider sustainability measures (over and above those required by the Building Regulations) with a payback period of less than 20 years. On this basis, the project board approved a number of design features including solar technology, enhanced thermal insulation, automatic lighting control, wintertime mechanical ventilation with heat recovery and propane chillers.

# Design

Solar technology has been used to steer the design of the overall building. The building's form and orientation maximises the north-south orientation of the roof pitches. The north facing pitches allow the maximum possible amount of daylight to enter the building without causing it to overheat, while the south facing pitches are covered in solar panels which provided 36% of the building's electricity needs in 2009.

Some 1,554 photovoltaic panels are situated on the southern aspects of the saw-toothed roof, providing a good percentage of the building's electrical power. They also over-sail the saw-tooth ridges to create shading for the north-lights to eliminate direct sunlight entering the building.

The building is designed on a north-south axis so that it can generate power through the solar panels on the south facing roof whilst eliminating glare in the office by using north facing windows.

The roof of the building has been specifically designed to provide an ideal location for photovoltaic panels (PVs) to generate electricity which is used in the building.

The whole building is managed by a Building Management System which constantly measures ventilation and heating to make sure the building works to its maximum potential.

The roof was pitched at a 30° angle to maximise potential output from photovoltaic panels. Rooflights were placed on the north-facing side of the pitched roof, and the PVs were cantilevered off the south side to provide shading to the rooflights, so limiting high solar gains.

The photovoltaics, which provide the shading to the rooflights have a primary purpose of generating electricity. At 1300m<sup>2</sup> the array is one of the largest in the country and provides up to 15% of the total electrical load of the building.

## Right Natural ventilation and photovoltaic panels

# Funding

65% of the project cost was funded by a government grant from the DTI and 35% by the National Trust.

# Carbon reduction

Heelis is expected to generate just 15kg of carbon dioxide per square metre per year compared to 169kg for a typical air conditioned office and 57kg for a typical naturally ventilated office.





# Review

## Performance

■ The National Trust expected to save a significant amount in running costs and administration costs due to the improved working practices provided by the new building.

■ We expect the installation to provide about a third of the electricity we use in the building, producing a major and increasingly important operational saving as energy costs continue to escalate. The panels also act as shading to the north facing windows, an ingenious solution to the problem of solar glare within the building on mid summer days.

**Energy generation** On average the photovoltaic cells produce 15% of energy, but can peak at 40%. Any surplus would go back to the grid but the location of a Communications Room at Heelis has not resulted in production of a surplus to date. It is believed to be one of the largest spans of solar panels in office use in the UK.

**Maintenance** The Trust has an ongoing maintenance agreement with the installers, Solar Century, who make an annual visit to clean the PV panels, check the function and produce a report on the performance of each panel.

## Engagement

■ Since opening, the building has become a visitor attraction in its own right. Many visitors come to see an example of best environmental building practice. Supporters and members come to look around the Central Office on organised tours. School parties have themed interactive educational visits that have proved very popular. We have also participated in seminars on building sustainability, sharing its best practice in order to benefit a wider range of people.

■ Visitors of all sectors want to see and understand the building. Not only have we been inundated by our supporters, we also show around large numbers of professionals who want to learn from us and see our environmental systems working in practice.

■ A PV display panel in the public area of the building shows:

- Real-time energy readings.
- Total cumulative.
- Carbon saved since the building was opened.

## Lessons learnt

■ In its first year Heelis fared well. During the hottest period in July the external temperature pushed 30°C on four days. Internal temperatures only once peaked at over 28°C and were less than 25°C for over half of the month. These sunlit summer days enabled the photovoltaic array to produce up to 30% of the building's electricity requirement. However there is a large base electricity load, even at night, due to the cooling required by the Communications Room. A significant lesson learnt was the large amount of electricity required by the Communications Room and the Kitchen, some 50% of the building's total requirement. In hindsight this should have been factored in from the outset.

■ Heelis has been continually monitored since its opening and environmental engineers are still fine tuning its operation. The Staff are kept up to date about the building in regular internal bulletins. Monitoring continues, which is especially important. These buildings take time to balance and attain optimum performance. Monitoring should be an element that is priced into the project from the outset.



## Best practice

■ The team defined sustainability targets early on. This helped guide the design to achieve a BREEAM rating of 'excellent'.

■ The building has already won awards in the construction industry, for its sustainability and innovative design including a prestigious AJ100 award from The Architects Journal.

■ Max Fordham engineers devised a sustainability matrix to judge all potential environmental options and only those that provided payback of less than 25 years were considered.

■ Taking the role of the informed client in design team briefings and early involvement meant the future operation of the building had a strong influence on the architectural and engineering solution.

**Above Side elevation showing PV and saw-tooth ridges**

# Further information

Heelis, Kemble Drive, Swindon SN2 2NA

## Developer

Kier Property

## Architects

Feilden Clegg Bradley

## Products

Solar Century

## Services

Max Fordham LLP

If you require this information in alternative formats, please telephone **01793 817791** or email **[buildingdesignguide@nationaltrust.org.uk](mailto:buildingdesignguide@nationaltrust.org.uk)**

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Above Heelis