

The University of Bradford

Improving the DEC rating from E to A for a library building for £1.7 million

The Revolving Green Fund (RGF) is a partnership fund between the Higher Education Funding Council for England (HEFCE) and Salix Finance Ltd. The Revolving Green Fund makes capital available to universities for investment to reduce greenhouse emissions within their building portfolio. The University of Bradford has used RGF funding to improve the energy performance of its 1970's library building. As a result of this the Display Energy Certificate (DEC) rating for the J B Priestley Library has been raised from Band E to B at a fraction of the cost of a new build library. Additional measures have subsequently been implemented to further improve the rating.

Location	Bradford, West Yorkshire
Measures Implemented	Refurbishment of existing 1970s university library building
Cost	£1.7million
Savings (£/annum)	~£100,000 (at £0.03/kWh [gas] and £0.12/kWh [electricity])
Savings (tCO₂/annum)	834
Simple Payback Period	<5 years

The University

The University of Bradford is a plate glass university – one of several universities founded in the United Kingdom in the 1960s – and received its Royal Charter in 1966. It has two campuses; the main campus located in the centre of Bradford and the School of Management located on the outskirts of the city. The majority of the buildings at the University are over 40 years old

The University of Bradford has undertaken a number of projects in recent years, to reduce carbon emissions, these include:

- improving the building management system and integration of plant shut down strategies
- changing the behaviour of staff and students
- installing a large Combined Heat and Power Plant (which will deliver an annual saving of 1,900tCO₂)

The University of Bradford's Carbon Management Plan sets out the University's carbon reduction targets as shown in Table 1, against the 2005 baseline levels. The Carbon Management Plan also includes details of plans to reduce carbon emissions by improving the energy performance of buildings on the campus. These include the construction of new BREEAM 'Outstanding' student accommodation and refurbishing the 1970s J B Priestley Library.

	2015	2020
Carbon reduction target (%)	54%	75%

Table 1 University of Bradford's carbon reduction targets



The Project

The University of Bradford received £1.7 million from HEFCE during Round 2 of the Revolving Green Fund, to refurbish the 11,361m² JB Priestley Library. The refurbishment was completed and the building handed over in October 2012.

In 2008 nine of the buildings on the University of Bradford campus had a DEC rating below D. Bradford's Carbon Management Plan outlines the University's commitment to improving the performance of these buildings. The JB Priestley Library building was selected as one of the buildings for renewal, as it has the highest footfall during term time (which impacts on its energy use) and it is one of most inefficient buildings (DEC rating Band E, 105).

During the early design stages, the University evaluated the potential cost for both the construction of a new library building and the refurbishment of the existing building. It was found that a refurbishment solution would deliver the same level of performance as a new building, at a fraction of the time and cost.

The University of Bradford set the ambitious aim of reducing the energy consumption of the library, and improve the DEC rating from E to A. Although the target rating was not achieved (a B rating was obtained) gas consumption for the building has been reduced by 73%.

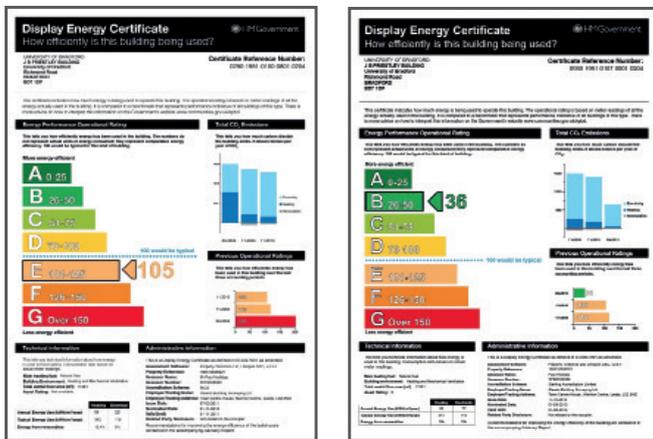


Figure 1 Display Energy Certificates pre and post refurbishment

HEFCE funded the refurbishment as it aimed to improve the performance of the building, through simple low carbon measures, whilst ensuring little disruption to the university staff and students.

The library refurbishment adopted a fabric first approach; large amounts of insulation were retrofitted to maximise thermal performance and airtightness; a large atrium was created for natural ventilation and natural lighting. Other measures included:

- Insulation – fabric insulation is approximately three times thicker than the current minimum standards required by building regulations. The library has been carefully sealed so that there are no excessive heat losses through draughts, and the fresh air delivered within the building can be controlled to match occupancy. The improvements to the building fabric have reduced the load for heating which has had a knock-on effect by reducing the size (and cost) of the heating system.
- Ventilation - mechanical ventilation system (with cooling) with a new mixed mode natural ventilation system. The temperature and air flow are controlled remotely using the Building Management System (which automatically opens and closes windows wherever it can to improve comfort).
- Passive cooling – ‘solar chimneys’ have been created within the atria for cooling: warm air rises up through the light wells and cooler fresh air is drawn through the walls at lower level. This is complemented by measures to increase the effective thermal mass of the building which moderates daily fluctuations in temperature. The large concrete building core helps to maintain the comfortable building temperature by absorbing and releasing heat out of phase with the outside temperatures (heat from the day is released at night helping to keep the building cool in the daytime. Internal temperatures will only approach/exceed the intended upper level of 28°C (triggering the need for mechanical

ventilation to cool the building) during spells of hot weather which are sufficiently prolonged to warm the building core.

- Improved daylight - the layout of each floor has been designed to allow people to study in the lightest parts of the building around the light wells and windows. The book shelves have been carefully placed and are of such a height that light can pass into those areas where it is most needed.
- Renewable heat – a biomass boiler has been installed to supplement conventional heating sources.

Mark Wrigley, Engineering Manager at the University of Bradford, stated that “the sector should celebrate the University of Bradford’s success and share project learning both within the sector and externally, informing future thinking, approach and project outcome for all parties involved within the project process.”

Other environmental measures have also been incorporated within the building and its operation, including: recycling and composting collections; and low water flow fittings in the toilets.

The project also introduced metering and a building management system (BMS) to monitor performance. The metering reports are circulated internally, to HEFCE, the wider university audience and the original design team so that the improvements in energy performance are highly visible. Events have also been held to disseminate the information more widely.

Any significant deviations from the expected energy consumption result in a site and/or BMS investigation to identify any plant performance issues. The data is used on a regular basis to monitor the overall project performance post occupancy by allowing a comparison of intended project performance with actual performance to take place resulting in a greater understanding of where and why differences have occurred.

Performance Data

The low carbon measures have had a dramatic improvement to the JB Priestley Library performance. From 2011/12 to 2012/13 results show a decrease in gas consumption of 73%, a reduction in water consumption of 55% and an 18% reduction in electrical consumption. Through the refurbishment of the library, Bradford has reduced its spend on gas, by £48,100 from 2011/12 to 2012/13, and £51,921 for electricity.

Figure 2, shows the trend in gas consumption from 2011/12 to 2012/13. The graph shows that the improved thermal performance of the building has reduced the impact of the weather on the building's heating demand: prior to the refurbishment the gas consumption for a winter month could be five times as much as in summer but it is now almost constant at around 50,000kWh per month throughout the year.

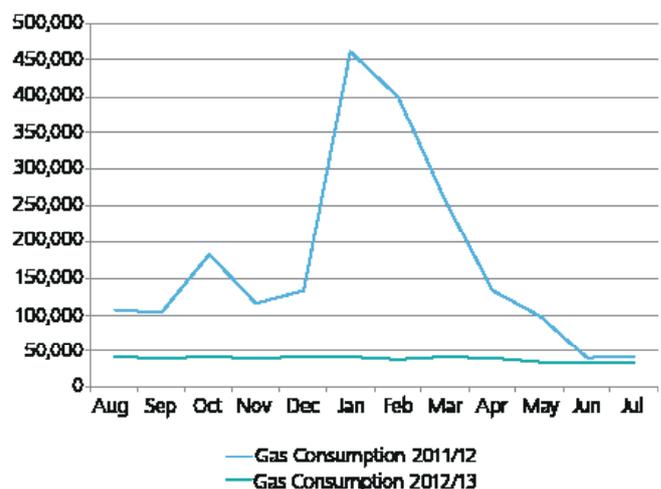


Figure 2 JB Priestley Library gas consumption from 2011/12 to 2012/13

The RGF Process

To seek the RGF funding, an investment team was established to explore external funding streams and approach potential funding bodies (including HEFCE) on a regular basis to maximise capital work opportunities.

The University believes that the RGF process ensures due diligence and avoids speculative submissions. They found the format and process was supportive of the business case approach that undertake for similar projects.

Whilst the submission itself wasn't found to be particularly time consuming, the University of Bradford's submission went through a number of internal checks and approvals before submission, which lengthened the official process. Guidance received from HEFCE was clear and informative, and if further assistance was required HEFCE staff were very supportive.

Bradford were required to provide interim reports during the construction phase including various elements of progress, spend and performance beyond project completion.

Lessons Learned

For the HEFCE submission an Equality and Disability Impact Analysis was undertaken. It highlighted potential issues surrounding access to the library for disabled users. This was the only area of concern and related to wheelchair users' access via stairs and lifts, and between the book shelves within the revised layout.

The University of Bradford stated that the only feedback that they have received with regard to equality and disability is anecdotal; however this has been positive, with a reported increase in the total numbers of library users, and observed improvement in behaviour and respect for the building.

The University believes that the project has been a success, as they have experienced a dramatic improvement in energy performance. The project was delivered at lower cost and within a shorter timescale than was predicted for a new build option.

Although the project hasn't quite achieved its ambition of achieving an 'A rating', since the project was completed the University has installed lighting controls and solar PV which will bring consumption and carbon emissions down further.

Benefits at a glance

Replicability	High
Impact:	
Display Energy Certificate (DEC) before refurbishment	105 (Band E)
Display Energy Certificate (DEC) after refurbishment	36 (Band B)
% reduction in gas consumption	73
% reduction in electrical consumption	18
Lessons Learned	<p>Refurbishment can achieve a dramatic improvement in energy performance.</p> <p>The project was cheaper and delivered quicker than a new build option.</p> <p>The project has resulted in additional benefits through increasing the number of students using the facility and boosting respect for the facility.</p>
Problems Resolved	<p>Modifications to the layout could potentially impact on accessibility – the project highlighted the need to consider all potential users which was formally undertaken through the Disability Impact Analysis.</p>

BRE would like to thank the following for their assistance in developing this case study:

Ben Tongue, University of Bradford

Mark Wrigley, University of Bradford

Lyn Ha, Energy Officer at the University of Bradford

Higher Education Funding Council for England (HEFCE) – Revolving Green Fund

The Revolving Green Fund (RGF) is a partnership fund between HEFCE and Salix Finance Ltd that aims to help higher education institutions (HEIs) in England reduce greenhouse emissions.

There have been three rounds of funding to date, providing £61 million in recoverable grants to institutions for projects that reduce their emissions. Institutions will repay the funds through the savings they make.

The fund has two strands, an 'Institutional Small Projects' (ISP) fund which allows the incremental implementation of small scale projects over time; and a 'Transformational' fund for large, one-off projects which significantly reduce an institution's carbon emissions.

It is intended that the Transformational projects will make predicted savings of 28,000 tonnes of CO₂ per year, a reduction of 1.3% in English HEI annual carbon emissions. In comparison the Institutional Small Projects are predicted to make savings of 17,353 tonnes of CO₂ per year, a reduction of 0.8% in English HEI annual carbon emissions.



For further information, please contact:

BRE, Watford, Herts, WD25 9XX

T: +44(0)333 321 8811

E: enquiries@bre.co.uk