

Costing sustainability:

How much does it cost to achieve BREEAM and EcoHomes ratings?

IP 4/05

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One of the principal barriers to the wider adoption of more sustainable design and construction solutions is the perception that these incur substantial additional costs. A costing analysis, using real cost data for a broad range of sustainability technologies and design solutions, contradicts this assumption.

This Information Paper presents some of the key findings from this costing analysis; namely, the capital costs associated with reaching increased levels of environmental performance, as defined by the BREEAM and EcoHomes schemes, for different building types and in different locations. It demonstrates that significant improvements in building sustainability performance can be achieved at very little additional cost. In addition, more sustainable buildings can offer major in-use cost savings. The full results of this study undertaken by BRE and Cyril Sweett for the BRE Trust are published in a new report, 'Putting a price on sustainability' (see page 4 for details).



Approach

The costs of achieving different levels of environmental performance were investigated for four different types of building:

- a house,
- a naturally ventilated office,
- an air-conditioned office, and
- a healthcare centre.

These buildings were chosen to represent typical industry projects in the UK. BRE's suite of BREEAM tools was used to determine options for improving environmental performance.

BREEAM provides a nationally recognised system for assessing the environmental performance of buildings. It measures this performance by awarding credits for complying with a broad rating of environmental standards.

The capital costs of each design, management or specification option were assessed and compared with a Building Regulations compliant standard (except in the case of the health centre where enhanced standards are typical). The capital costs quoted include: prelims, overheads, profits and contingencies. The costs are based on design

stage implementation rather than retrofitting. The most cost-effective options were favoured.

Many BREEAM credits relate solely to the location of the site, such as proximity to local amenities and public transport. In this study, three location scenarios were assessed:

- a poor location (where no location credits are achievable),
- a typical location (where a selection of location credits are achievable), and
- a good location (where all location credits are achievable).

The healthcare centre was not evaluated in a poor location because it was an unrealistic option for a building of this type.

Some credits were not assessed in this study as the costs were too location-dependent (eg ecological enhancement costs and planning for the long-term impact on biodiversity). In many cases, especially in poor locations, these can provide a cost-effective means of achieving a higher rating.

Figure 1 on page 4 shows the increasing capital costs against environmental performance for three building types.

Results

Case Study 1 — House

The environmental performance of this building was assessed with EcoHomes.



A base case house is assumed to meet Building Regulations with the following attributes:

- Capital cost £76,000
- Speculative new build, within a 40-unit development of two-storey, 4-bedroom semi-detached houses (gross floor area: 115 m²)
- Brick and blockwork cavity walls with insulation, concrete tile and timber truss roof; beam and block ground floor
- Water and space heating supplied by a standard combination boiler
- An EcoHomes Unclassified rating in all locations

Table 1 % increase in capital costs to achieve a Good, Very Good and Excellent EcoHomes rating in 3 locations

Location	% increase in capital cost to achieve a Pass/Good/Very Good/Excellent			
	Pass	Good	Very Good	Excellent
Poor	0.1	0.9	3.1	—
Typical	0	0.4	1.7	6.9
Good	0	0.3	1.3	4.2

The measures included for the typical location:

- Pass** Zero ODP insulation; responsibly sourced timber.
- Good** Low NO_x boiler; A-rated white goods; water-saving appliances.
- Very Good** Low-energy external lighting; water butt; recycling facilities; facilities for a home office; pre-completion sound insulation testing.
- Excellent** Increased insulation; A-rated materials in windows and floors; rainwater recycling.

The measures identified above provide predicted in-use savings of:

- 6% for energy,
- 40% for water.

Case Study 2 — Naturally ventilated office

The environmental performance of this building was assessed with BREEAM Offices.



A base case naturally ventilated office is assumed to meet Building Regulations with the following attributes:

- Capital cost £731,200
- Purpose-built, two-storey building with office space, small server room, toilets and foyer reception (gross floor area: 493 m²)
- Concrete ground floor slab, brick and blockwork cavity walls, concrete tile and timber truss roof, pre-cast concrete upper floor, fitted out with carpet on screed, suspended ceilings, toilet and kitchen facilities
- Low temperature hot water heating, mechanical ventilation to toilet areas, standard lighting, power, fire alarms, public health services and lift
- A Pass rating in a good and typical location and an Unclassified rating in a poor location

Table 2 % increase in capital costs to achieve a Good, Very Good and Excellent BREEAM rating in 3 locations

Location	% increase in capital cost to achieve a Pass/Good/Very Good/Excellent			
	Pass	Good	Very Good	Excellent
Poor	-0.4	-0.3	2.0	—
Typical	—	-0.4	-0.3	3.4
Good	—	-0.4	-0.4	2.5

The measures included for the typical location:

- Good** Remove A/C equipment in computer server room; plant commissioning.
- Very Good** Zero ODP insulation; responsibly sourced timber; low NO_x boiler; lighting to be specified between 350 and 400 lux; Considerate Constructors Scheme; water-saving appliances.
- Excellent** Water-saving devices; recycling facilities; building user's guide; high-frequency ballasts; sub-meters; increased insulation; increased luminaire efficiency; rainwater recycling; daylight sensors; zoned lighting; thermal modelling.

The measures identified above provide predicted in-use savings of:

- 17% for energy,
- 71% for water.

Good plant commissioning can result in significant additional savings.

Case Study 3 — Air-conditioned office

The environmental performance of this building was assessed with BREEAM Offices.



A base case air-conditioned office is assumed to meet Building Regulations with the following attributes:

- Capital cost £11,430,000
- Three-storey speculative office building consisting of a central atrium with toilets and showers adjacent on each floor plate (gross floor area: 10,098 m²)
- Concrete ground floor slab, steel frame with curtain walling and rain screen cladding, concrete upper floors, flat steel seam roof with a section of concrete slab supporting the plant located on the roof
- Four-pipe fan coil air-conditioning, mechanical ventilation, low temperature hot water heating, lighting, power, fire alarms, public health services and lifts
- A Pass rating in a good and typical location and an Unclassified rating in a poor location

Table 3 % increase in capital costs to achieve a Good, Very Good and Excellent BREEAM rating in 3 locations

Location	% increase in capital cost to achieve a Pass/Good/Very Good/Excellent			
	Pass	Good	Very Good	Excellent
Poor	0	0.2	5.7	—
Typical	—	0	0.2	7.0
Good	—	—	0.1	3.3

The measures included for the typical location:

- Good** Responsibly sourced timber; plant commissioning.
- Very Good** Zero ODP insulation; lighting to be specified between 350 and 400 lux; Considerate Constructors Scheme; sub-meters; recycling facilities; building user's guide; low NO_x boiler; seasonal commissioning; water-saving appliances; intake and extract ducts to be separated to prevent the recirculation of air.
- Excellent** Increased luminaire efficiency; water-saving devices; zoned lighting; full-time monitoring of site impacts; heat recovery system; rainwater recycling; increased insulation; secure cycle storage; daylight sensors; occupant-controlled blinds; PV and solar thermal panels; ammonia as refrigerant.

The measures identified above provide predicted in-use savings of:

- 26% for energy,
- 55% for water.

Good plant commissioning can result in significant additional savings.

Case Study 4 — PFI health centre

The environmental performance of this building was assessed with Bespoke BREEAM.



The building was procured as a private finance initiative (PFI) project. The building's actual performance was used as the base case. The building's attributes are as follows:

- Capital cost £11,590,000
- Three-storey health centre comprising consultation and treatment rooms, offices, meeting rooms, plant rooms, waiting areas and a foyer (gross floor area: 6400 m²)
- Concrete ground floor slab, concrete frame and upper floors, part pitched, part flat lightweight metal roof, laminated timber panel walls, curtain walling and rainscreen cladding
- Low temperature hot water heating with low NO_x boilers, mechanical ventilation to inner areas, toilet extraction, local comfort cooling, domestic hot water via storage calorifiers, fluorescent lighting, security systems, BMS, fire alarms, public health services and lifts
- A Good rating in both the typical and good locations

Table 4 % increase in capital costs to achieve a Good, Very Good and Excellent BREEAM rating in 2 locations

Location	% increase in capital cost to achieve a Pass/Good/Very Good/Excellent			
	Pass	Good	Very Good	Excellent
Typical	—	—	0	1.9
Good	—	—	0	0.6

The measures included for the typical location:

- Very Good** Remove comfort cooling and replace with mechanical ventilation; zero ODP insulation; responsibly sourced timber; minimise external light pollution; A-rated external hard surfacing; provide travel information; Considerate Constructors Scheme.
- Excellent** Water-saving devices; seasonal commissioning; building user's guide; recycling facilities; zoned lighting; increased insulation; secure cycle storage; rainwater recycling; renewables feasibility study; full-time monitoring of site impacts; increase material durability.

The measures identified above provide predicted in-use savings of:

- 3% for energy,
- 10% for water.

Discussion

This research illustrates that improving building sustainability performance can be achieved without significantly increasing the capital cost. As shown in Figure 1, the environmental performance can be increased by 1–3 BREEAM/EcoHomes ratings levels for <2% additional capital cost. A number of key issues were highlighted.

● Timing

Many BREEAM credits are affected by basic building form and servicing solutions. Cost-effective BREEAM compliance can only be achieved if careful and early consideration is given to BREEAM-related design and specification details. Clear communication between the client, design team members and, in particular, the project cost consultants, is essential.

● Location

Building location and site conditions have a major impact on the costs associated with achieving 'Very Good' and 'Excellent' compliance. We recommend that the location-dependent credits excluded from this study are given full consideration by project teams as they can offer a more cost-effective means of achieving the higher ratings.

● Procurement route

PFI, and similar methods of procurement, that promote a long-term interest in building operations for the developer/contractor, typically have a positive influence on the building's environmental performance and any costs associated with achieving higher BREEAM ratings.

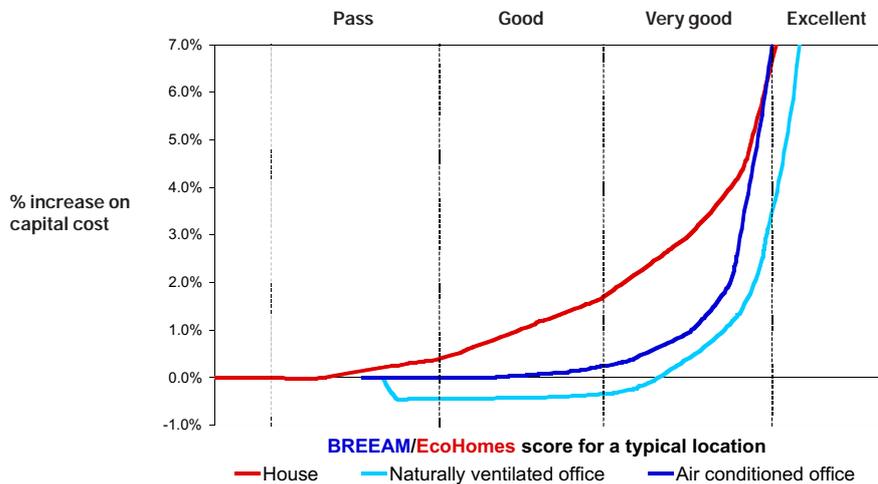


Figure 1 Increasing capital costs against environmental performance for three building types

Further reading and information

For more information on this study:

BRE & Cyril Sweett. *Putting a price on sustainability.* FB10. 2005.

For detailed requirements of BREEAM and EcoHomes:

www.breeam.org.uk

Baldwin R, Yates A, Howard N & Rao S.

BREEAM 98 for offices. BR 350. 1998.

Rao S, Yates A, Brownhill D & Howard N.

EcoHomes: The environmental rating for homes. BR 389. 2000.

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BRE Trust Report (FB10) 'Putting a price on sustainability'

This *Information Paper* focuses on the overall capital cost implications of achieving BREEAM ratings. During the study, a range of measures were identified that can be implemented at little cost; some of them are available at no additional cost and some even offer a cost saving.

Full details of the study are given in a BRE Trust report, *Putting a price on sustainability*, including the costs of each of the sustainable solutions, together with their impact on the BREEAM rating. This report is available from BRE Bookshop. (Tel 01344-404407; email brebookshop@ihrapidoc.com)

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March 2005

ISBN 1 86081 742 4



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