

A COMPARISON OF BREEAM AND LEED ENVIRONMENTAL ASSESSMENT METHODS

A REPORT TO THE UNIVERSITY OF EAST ANGLIA
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Aim of Report

The aim of this report is to provide a comparison of BREEAM and LEED environmental assessment methods applied to UK buildings, and to assess whether or not there is parity between their respective rating classifications.

This report draws on information and guidance published by the Building Research Establishment (BRE) and the US Green Building Council (USGBC) as well as recent independent articles.

Comparison Overview

This report compares each method's current version for new-build projects as described in the following outlines:

- *BREEAM*

Building Research Establishment's Environmental Assessment Method (BREEAM) was launched in 1990 and is currently the world's most widely adopted environmental assessment method with over 200,000 projects certified at the time of writing. Over 300 buildings outside of the UK have been registered for assessment.

The current version of the scheme for new-build projects is BREEAM 2011 New Construction⁽¹⁾.

- *LEED*

Leadership in Energy and Environmental Design (LEED) was developed by USGBC in 2000 and is currently the world's second most widely adopted method with 24,682 projects comprising 151,692,972 sq m certified in 120 counties at the time of writing.

The current version of the rating system for new-build projects is LEED 2009 for New Construction and Major Renovations (NC)⁽²⁾.

The proposed 2012 update completed its second public comment period in September 2011 and is currently undergoing review by the USGBC's circa 15,000 member companies and organisations plus local chapter individual members.

The early development of LEED was to some degree influenced by BREEAM, and as such they take a common approach in so far as they assess a building against multiple issues or categories and award credits which are then allocated weighted points based on their environmental impact, with the points total determining the rating classification.

Both methods have specific rating schemes and systems for different building uses such as office, industrial, education, healthcare, etc. They both rely on existing building regulations and other third party standards to set performance criteria in many areas of assessment for reasons of pragmatism as well as credibility, while fundamentally seeking (and needing) to exceed such standards.

Although they have a common environmental aim, there are significant differences in their detailed methodologies, scope and emphasis of assessment, metrics, and certification processes.

A common standard would facilitate benchmarking of buildings across different countries and encourage the adoption of sustainability targets for entire international building portfolios. With this ultimate aim, in 2009 BREEAM, LEED and Green Star⁽³⁾ announced a memorandum of understanding to jointly develop common metrics to measure CO₂e emissions and seek to align the tools, measurement and reporting. This initiative is still a work in progress, and is a prerequisite for seeking to agree common performance standards. Any attempt at integration will need to take account of the regional variation in environmental conditions, impacts and priorities (for example as LEED does with its Regional Priority credits) as well as local regulatory minimum standards and baseline assumptions.

A comparison of BREEAM and LEED is summarised in Table 1 as follows:

Table 1: Comparison Summary

	BREEAM 2011	LEED 2009
Proprietor	BRE Global Ltd	US Green Building Council
BREEAM Schemes / LEED Rating Systems	<ul style="list-style-type: none"> • New Construction* • Refurbishment • Code for Sustainable Homes • Communities • In-Use <p>(*New Construction assesses the following building types: offices, industrial, retail, data centres, education, healthcare, prisons, law courts, multi-residential institutions, non-residential institutions, assembly & leisure and other)</p>	<ul style="list-style-type: none"> • New Construction and Major Renovations • Existing Buildings: Operations & Maintenance • Commercial Interiors • Core & Shell • Schools • Retail • Healthcare • Homes • Neighbourhood Development
Rating Classifications	Pass, Good, Very Good, Excellent and Outstanding	Certified, Silver, Gold and Platinum
Number of Credits	Up to c. 150 credits depending on building type	49 credits
Minimum Standards	Minimum standards are tiered based on the target rating, eg pertaining to 4 specific credits or criteria for a Pass rating, 6 for Good, 8 for Very Good, 18 for Excellent and 26 for Outstanding	8 prerequisites in addition to the above credits, plus 7 primary Minimum Program Requirements for eligibility which apply across all rating systems (except those adopted pre-2009)
Credit Weighting	Based on relative environmental impact, reviewed periodically	Based on relative environmental impact and human benefit, reviewed periodically
Evidence Collation	BREEAM Assessor, design, construction & management teams and Accredited Professional (AP).	Design, construction & management teams and Accredited Professional (AP)
Assessment / Review	Design Stage & Post-Construction Assessment by trained and licensed BREEAM Assessors	Design & Construction Review by Green Building Certification Institute (GBCI) through network of third party certification bodies
Certification	BRE	GBCI
QA	BRE & UKAS	USGBC
Registration and Certification Fees	<ul style="list-style-type: none"> • Registration £120 • Certification £1,170 	<ul style="list-style-type: none"> • Registration \$900 (USGBC members) or \$1,200 (non-members) • Certification incl. in Review Fee
BREEAM Assessment / LEED Review Fees	Design Stage & Post-Construction Assessments: c. £5,000-£15,000 (not fixed; varies by project size/complexity and market competition between BREEAM Assessors)	Design & Construction Reviews: <ul style="list-style-type: none"> • < 50,000 sq ft: \$2,250 (members), \$2,750 (non-members) • 50,000-500,000 sq ft: \$0.045/sq ft (members), \$0.055/sq ft (non-members) • > 500,000 sq ft: \$22,500 (members), \$27,500 (non-members)

Accredited Professional Fee	c. £5,000-£10,000. Varies by project size, complexity and market competition between APs.	\$10,000-\$30,000 (Inbuilt, 2010). Varies by project size, complexity and market competition between APs. Higher on average partly because of the AP's greater involvement in collating evidence as there is no "assessor" role.
Credit Appeal Fee	Free of charge	Complex credits \$800 per credit, all other credits \$500 per credit
Credit Interpretation Request Fee	Free of charge	\$220 per credit
Availability of Information	Pre-Assessment tool and Scheme Manual available free of charge. Technical guidance only available by attending BREEAM Assessor and/or AP training courses run by the BRE.	Tools and public guide can be downloaded free of charge. Reference Guides cost \$195 (hardcopy) or \$180 (e-book) for each rating system. Further technical guidance available through LEED Green Associate and AP training courses.

Environmental Assessment Areas

A comparison of the BREEAM Environmental Sections, LEED Environmental Categories and their respective weightings is set out in Table 2 as follows:

Table 2: Comparison of BREEAM and LEED Assessment Areas

BREEAM 2011		LEED 2009		
Environmental Section	Max. Weighted % Points	Environmental Category	Weighting	Max. Points
Land Use & Ecology	10%	Sustainable Sites	23.6%	26
Water	6%	Water Efficiency	9.1%	10
Energy	19%	Energy & Atmosphere	31.9%	35
Materials	12.5%	Materials & Resources	12.7%	14
Health & Wellbeing	15%	Indoor Environmental Quality	13.6%	15
Transport	8%	Innovation in Design	5.5%	6
Waste	7.5%	Regional Priority	3.6%	4
Pollution	10%	Total	100%	110
Management	12%			
Innovation (additional)	10%			
Total	110%			

The sections/categories highlighted in the above table are broadly comparable, however because their parameters are different they are not directly comparable. For example:

- LEED Sustainable Sites includes issues covered mainly by BREEAM Land Use & Ecology, but also by Transport, Pollution and Management.
- LEED Energy & Atmosphere includes issues covered mainly by BREEAM Energy, but also by Pollution and Management.
- LEED Materials & Resources includes issues covered mainly by BREEAM Materials, but also by Waste and Management (Reed et al., 2010).

Inbuilt (2010) compared BREEAM Offices 2008 (now superseded) with LEED 2009 NC and found that c. 34% of the points available in BREEAM were not available in LEED, and 16 of the points available in LEED were not available in BREEAM. Generally, BREEAM has a broader scope in terms of social impacts compared to LEED.

Weighting of Credits

BREEAM Environmental Sections are weighted according to their relative environmental impact which is determined by periodic stakeholder consultation and expert panel review. The detailed definition of the weighting system is set out in the BRE Global Core Process Standard (BES 5301).

Each LEED credit is allocated points based on the relative importance of its building-related environmental impact and human benefit. Credit weightings also reflect LEED's recognition of the market implications of point allocation. The result is therefore a weighted average that combines building impacts and the relative value of the impact categories. The weighting system is currently under review and development as part of the above mentioned 2012 version update.

Rating Benchmarks and Classification

Both methods have a tiered classification structure as shown in Table 3 as follows:

Table 3: Rating Benchmarks

BREEAM 2011	% Points	LEED 2009	Points
Outstanding	≥ 85%	Platinum	≥ 80
Excellent	≥ 70%	Gold	60-79
Very Good	≥ 55%	Silver	50-59
Good	≥ 45%	Classified	40-49
Pass	≥ 30%	Unclassified	< 40
Unclassified	< 30%		

It does not follow however that there is parity between what appears to be the corresponding rating classification under each method. In a statistical analysis comparing specifically the energy assessment criteria of earlier versions of BREEAM, LEED and HK-BEAM⁽⁴⁾ applied to 60 HK-BEAM certified buildings, Lee and Burnett (2007) found that it was most difficult to score credits under BREEAM.

In a modelling study comparing the application of later versions of BREEAM, LEED, Green Star and CASBEE⁽⁵⁾ methods to assess the performance of buildings in the UK against all of the available credits, Saunders (2008, p.42) found that:

“it is tougher to meet the highest rating in BREEAM than it is to meet the requirements of the alternative schemes when building in the UK. If a building is designed to meet the highest LEED [Platinum] or Green Star [Six Stars] rating it is only likely to achieve a BREEAM result of Very Good or Good which are the second and third highest ratings respectively.”

“none of the schemes travel well if used in countries other than those which the system was initially designed to work in. ... where used outside the native country, any of the systems should be tailored to take account of the local context.”

Table 4 illustrates this finding as follows:

Table 4: Approximate Rating Comparisons for a Building Constructed in the UK

EXCELLENT			
VERY GOOD	PLATINUM	SIX STARS	
		FIVE STARS	S
GOOD	GOLD	FOUR STARS	A
	SILVER	THREE STARS	B+
PASS		TWO STARS	B-
	CERTIFIED	ONE STAR	C
BREEAM	LEED	Green Star	CASBEE

Source: Saunders, 2008, Table 3, p.41

Saunders' study compared BREEAM 2006 and LEED v2.2 (2005), both superseded by the current versions, and was undertaken before the BREEAM Outstanding rating was introduced in August 2008. Although BRE commissioned and published the study, it is worth noting that it has been cited in articles by Dirlich (2011) and Reed et al. (2011).

The study suggested that the high degree of variation in standards was partly attributable to each system relying on local regulatory minimum standards to form baseline assumptions and measure performance improvement. USA Building Code standards are generally lower than those of UK Building Regulations, consequently LEED sets lower standards than BREEAM on a number of performance criteria where these form the baseline.

Local and regional contexts make direct comparison difficult. For example, LEED is aligned with climates in which buildings use mechanical ventilation and air conditioning, and where existing infrastructure promotes the use of cars and/or offers relatively fewer public transport alternatives.

It is also worth noting that both of the above mentioned studies were based on earlier versions of the assessment methods that have been superseded and improved, as have local building regulation/code standards. Furthermore, the current versions offer some degree of adaptation for projects outside of the UK and USA respectively – through Country-Specific BREEAM Schemes via framework agreements with National Scheme Operators⁽⁶⁾, and to a lesser extent through LEED Alternative Compliance Paths⁽⁷⁾.

BREEAM's Relative Strengths

- *Minimum Standards*

BREEAM's minimum standards, pertaining to specific credits or specific criteria for credits, are tiered based on the target rating, ranging from four to 26 credits or criteria as set out in Table 1 above. This enables the scheme to progressively achieve key priorities and greater impact on a building's sustainability at the highest ratings, whereas LEED has a fixed number of eight prerequisites applicable across all rating classifications (plus one of the seven Minimum Program Requirements pertaining to sharing energy and water usage data considered to be comparable).

- *Energy Consumption / CO₂ Reduction*

BREEAM encourages reduction in CO₂ to zero net emissions in relation to Building Regulations Part L 2010 to achieve maximum points worth 10.56% of the total score. LEED targets energy cost

reduction, instead of CO₂, based on improvement over an ASHRAE 90.1-2007 baseline, and offers maximum points worth 17% of the total score for an energy cost reduction of only 48%. This reaffirms the above mentioned findings of Lee and Burnett (2007) in relation to earlier versions of both methods.

- *Energy Sub-Metering*

BREEAM has a compulsory minimum standard of sub-metering substantial energy uses for Very Good, Excellent and Outstanding ratings. LEED has no energy sub-metering prerequisite.

- *Life-Cycle Cost Analysis*

There are no LEED credits for life-cycle costing, therefore it may not encourage the most environmentally efficient allocation of capital.

- *Materials*

In relation to sustainable materials and life-cycle impacts, BRE has produced the Green Book Live and the Green Guide to Specification⁽⁸⁾ which provide useful information for designers and make it more likely to achieve these credits (and the environmental benefit), whereas under LEED, designers seeking to achieve corresponding credits must rely on a multiplicity of manufacturers' and/or third parties' product evaluations/certifications (Reed et al., 2010, p.147) or relatively simplified checklists (Saunders, 2008, p.25).

- *Transport*

BREEAM's travel plan credit is more rigorous in relation to actual accessibility of public transport compared to LEED which does not take account of the routes, hours of service and frequency of service. Furthermore this BREEAM credit includes a requirement to actively encourage alternative options to car or other high environmental impact forms of transport.

LEED's Relative Strengths

- *Transparency*

LEED's approach is more consensus-based and transparent compared to BREEAM's. For example the technical criteria proposed by the various LEED committees are publicly reviewed for approval by USGBC's c. 15,000 member companies and organisations. However the USGBC has in the past been criticised for being unduly influenced by the manufacturers, contractors and developers in its membership rather than by scientific research (Gifford, 2008).

- *Resources*

LEED provides more extensive publicly accessible resources, research and case studies than BREEAM. This includes, for example, the Green Building Information Gateway⁽⁹⁾, a "map-centric" portal providing LEED certification data and analysis at national, state, city and project level. BREEAM does not publish data on numbers of buildings certified by type and rating achieved.

- *Post-Occupancy Evaluation*

Post-occupancy evaluation (POE) provides the scheme operators with valuable feedback on the effectiveness of particular credits in terms of their take-up and actual environmental impact, which it can use to disseminate best practice and inform future development of the assessment method.

LEED is more rigorous in this regard. Under the compulsory Minimum Program Requirements, all certified projects must commit to sharing with USGBC/GBCI all available actual energy and water usage data for the whole project for a period of at least five years from occupancy. This commitment continues if there is a change of ownership or occupation. In addition LEED offers a credit to develop and implement an energy consumption measurement and verification plan as well as a corrective action process for a minimum of one year post-occupancy.

Under BREEAM an optional exemplary level credit is available for committing to the following for three years post-occupancy: (a) collecting occupier satisfaction, energy and water consumption data, (b) utilizing the data to maintain expected performance, (c) setting reduction targets and monitoring water and energy consumption and (d) providing annual consumption and satisfaction data to the design team/developer and BRE.

- *Heat Island Effect*

LEED has credits for reducing the heat island effect (for example through shading by trees and specifying high solar reflectance materials). BREEAM does not address this, and although it offers credits for green roofs, it is for the purposes of mitigating ecological impact and reducing surface water run-off.

- *Thermal Comfort*

Although both methods address thermal comfort through design, only LEED offers an additional credit for verification – by way of a survey of occupiers between 6 to 18 months of occupancy, and a corrective action plan in the event that more than 20% are dissatisfied with thermal comfort.

- *Indoor Air Quality*

LEED's indoor air quality credit requirements are more sophisticated than BREEAM's, driven by the USA's climate and greater reliance on mechanically ventilated and air conditioned buildings. Furthermore, LEED addresses indoor air quality (IAQ) and mould prevention post-construction but prior to occupancy by offering a credit which requires either a full air flush-out in accordance with specific air volume, temperature and relative humidity parameters, or IAQ testing consistent with EPA or ISO methods. BREEAM has no such requirements.

- *Irrigation*

LEED's water efficient irrigation credit offers a higher number of points with stricter requirements and a specified threshold – ie a minimum 50% reduction in potable water use for irrigation. BREEAM's water efficient equipment credit requires specified water efficient strategies/systems but does not quantify a required reduction in water use.

Conclusions

Although there is a considerable degree of commonality between BREEAM and LEED in terms of their aims, approach and structure, there are significant differences in terms of scope of environmental issues addressed, metrics and performance standards. The LEED certification process is more expensive primarily because its business model is based on a monopoly of supply of assessment.

Although studies indicate that BREEAM's scope is wider and its standards are on the whole more difficult to achieve than LEED's, they also demonstrate that direct comparison of rating classifications under each method is not straightforward. Meaningful comparisons of actual individual project ratings would require each project to be assessed under each method, which would be costly and unlikely to be undertaken. Alternatively, statistical or modelling analyses require a process of normalisation of credits and local contextual factors, which in turn involves a number of value judgements.

BREEAM and LEED continue to compete and develop against a background of continually improving regulatory standards and dissemination of best practice worldwide. If, in addition, common metrics and performance standards can be agreed then both methods may eventually achieve a sufficient degree of parity which would mutually enhance their usefulness. Until then, LEED certification of UK buildings may be perceived to be of less value than BREEAM certification, unless the UK buildings assessed constitute a relatively small part of an international portfolio where the need to benchmark globally takes priority over the merits of the predominant local methods.

Notes

- (1) The BREEAM 2011 New Construction Scheme Manual is available at: <http://www.breeam.org/BREEAM2011SchemeDocument/>.
- (2) The LEED 2009 for New Construction and Major Renovations (NC) public guide is available for free at: <http://www.usgbc.org/ShowFile.aspx?DocumentID=8868>. The Minimum Program Requirements are available for free at: <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=2102>. Reference Guides can be purchased at: www.usgbc.org/Store/PublicationsList_New.aspx?CMSPageID=1518.
- (3) Green Star was developed by Sinclair Knight Merz and BRE for the Green Building Council of Australia in 2003, and is the world's third most widely adopted building environmental assessment method with 379 projects comprising 5,572,559 sq m certified currently reported. Further information available at: <http://www.gbca.org.au/project-directory.asp>.
- (4) HK-BEAM (Hong Kong Building Environmental Assessment Method). Further information available at: <http://www.beamsociety.org.hk/general/home.php>.
- (5) CASBEE (Comprehensive Assessment System for Building Environmental Efficiency) was developed by the Japan Sustainable Building Consortium in 2004. Further information available at: <http://www.ibec.or.jp/CASBEE/english/index.htm>.
- (6) Information on Country-Specific BREEAM Schemes and National Scheme Operators available at: <http://www.breeam.org/page.jsp?id=348>.
- (7) Information on Alternative Compliance Paths is contained in the LEED 2009 NC public guide available at: <http://www.usgbc.org/ShowFile.aspx?DocumentID=8868>, p.xiii.
- (8) Information on the Green Book Live available at: <http://www.greenbooklive.com/>. Information on the Green Guide to Specification available at: <http://www.bre.co.uk/greenguide/podpage.jsp?id=2126>.
- (9) USGBC resources available at: <http://www.usgbc.org/DisplayPage.aspx?CategoryID=20>. Green Building Information Gateway available at: <http://gbig.org/>.

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