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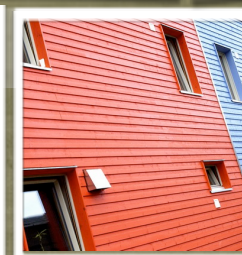
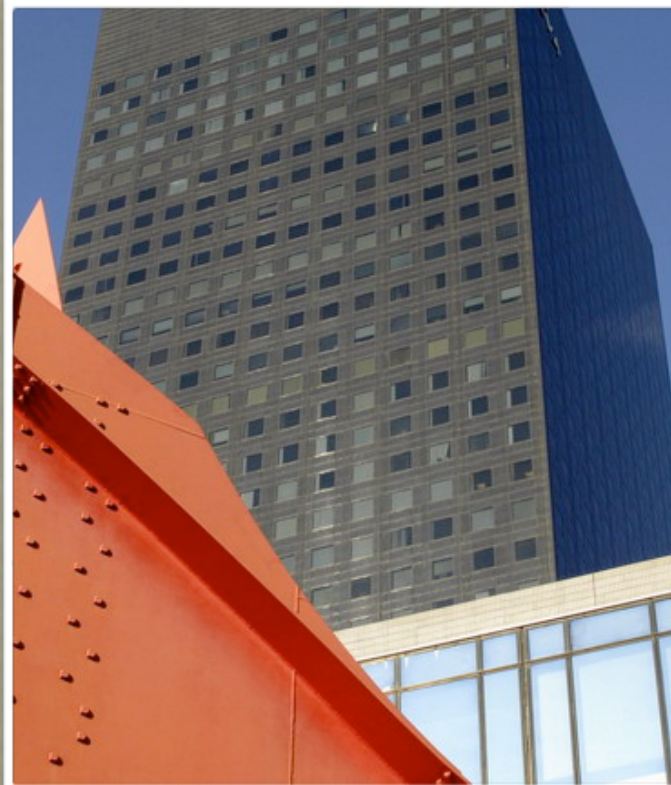


UNEP SBCI
Sustainable Buildings &
Construction Initiative



UNEP Finance Initiative
Innovative financing for sustainability

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UNEP-FI / SBCI'S FINANCIAL & SUSTAINABILITY METRICS REPORT

An international review of sustainable building performance indicators & benchmarks

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Executive summary

This report brings together current thinking on defining and measuring sustainability in the context of the built environment. It sets out concisely the key issues in this large and complex area. In this report, the Brundtland definition of sustainability is used: «meeting the needs of the present without compromising the ability of future generations to meet their own needs». Unfortunately the simplicity of this definition belies what is a complex web of systems and cycles in science, economics, politics, ethics and engineering. Fortunately, Pioneers of sustainability assessment in the built environment have devised ways of addressing sustainability measurement and delivery by focusing on the key issues in terms of economic, environmental and social. Through clarity, transparency, stakeholder engagement, and peer review, the leading organizations are also attempting to achieve the objective of Brundtland. This requires that as understanding improves, we identify and reconcile all of the key issues, which are inextricably interwoven. If we are not to solve the problems of sustainability, we need numbers, not adjectives and must base what we do on «evidence not public relations» (MaKay, 2008)

Definition of common core of sustainability indicators

The analysis of existing assessment systems carried-out in this report demonstrates that historically such systems have been predominantly developed to assess environmental issues and that, even now, few of them could currently be considered to adequately assess the full range of sustainability issues.

The reasons for this are in themselves, a potential area of further research but are likely to be, at least partially, due to the fact that environmental issues are typically easier to quantify and can therefore be assessed objectively. Social and economic sub-issues are often difficult to assess either relying on subjective judgment or complex calculations which do not sit well in assessment systems that aim to be objective and time /cost effective to use.

It should be noted that, whilst the core indicators identified in this report are as applicable to new as to existing operational buildings, a number of issues need further consideration to allow the development of a core set of indicators that could be used to assess the sustainability of buildings in any location. These are listed below:

Scale of assessment

Many of the issues related to building impacts (especially social and economic) are difficult to influence when considered on the basis of a single building and would be more suitably addressed at a neighborhood or development level. The extension of this study to cover systems such as CASBEE for Urban Development, LEED Neighborhoods and other schemes under development such as BREEAM Communities would identify whether this is a major reason for the current imbalance between these issues in building scale systems.

Balance of environmental, social and economic issues

As noted earlier, the majority of issues common to all systems are environmental. When considering developing countries, which are likely to have a far less developed construction infrastructure, it could be considered even more important to consider issues related to social and economic impacts. The development of local employment opportunities, use of local materials and community involvement in projects, to name but a few, is likely to be far more important when attempting to establish a sustainable construction industry in a developing country.

Tailoring to local context

What is apparent is that none of the systems reviewed 'travel' well if used un-adapted to the local context. This is not solely due to technical issues (i.e. the need to measure such systems against national standards) but is also affected by the cultural acceptability of such systems (i.e. the way in which buildings are procured, constructed and operated). Added to this, the more widely used systems (i.e. those covered by this review) have evolved from countries with well developed construction industries and therefore would require further adaptation to be used within developing countries.

Degree of technical rigour

One of the major issues that define the success of building assessment systems is the balance between usability and technical rigour. Whilst any system must be built on strong scientific foundations it is also important that the approach not be so academic as to render the system unwieldy in terms of either requirements or the time taken to carry out the assessment. It would be advisable to consider 'tiers' of complexity for any such system that would allow a developing country to adopt a simple system at the outset but to build in more detail as their construction industry develops.

Most effective means of benchmarking

Typically, the systems reviewed benchmarked building performance against established local regulations, codes and standards only resorting to 'bespoke' benchmarks where necessary. In the case of developing countries there is likely to be a far less developed set of such standards and so it would be necessary to define the process by which suitable local benchmarks could be set where no local standards exist.

Financial indicators

The analysis in this report demonstrates that within the property sector sustainability issues link through to financial performance in many ways. But, whilst in some cases the relationships are straightforward, in others they are less clear and more difficult to measure.

The current need is for new decision support instruments for property professionals and decision makers. Investors are currently forced to analyze and evaluate various aspects of building performance whilst also having to take into account a variety of complex institutional influences and externalities. The success of their investments depends on their ability to interpret all of these complex factors. As a result any decision support instruments will have to allow for interlinking information from many different and diverse sources which may vary depending on the life-cycle of a building. Most importantly, such instruments will need to bridge the gap between financial, environmental, social, physical and technical performance measures in order to establish the necessary feedback mechanisms to incentivize and drive change in the property industry.

In order to facilitate the integration of the traditional methods and tools for valuation, risk analysis and cost estimation with the methods and tools developed by the sustainable building community for assessing and communicating the contribution of buildings to sustainable development it will be necessary to develop new methods of information management. This would enable information collected at, for example, the construction stage to be stored in order that it could then be used when assessing a building's value later in its life cycle.

Also, as the information gathered on buildings is often complex and not understandable by all stakeholders it is important to identify new means for displaying data and performance reporting in a clear and understandable manner. For example the production of executive reports could be used by investors to concentrate on strategic issues, such as how real estate affects the balance

sheet whilst reports for operational purposes could be more detailed providing information on operating costs, rent levels, etc.

Introduction

Buildings constitute a central function in all societies, providing housing, work places, trade centers and living spaces. The use and function of buildings has a direct impact on the health, comfort, safety, economy, and quality of life of citizens. In addition, buildings have a large environmental impact both in terms of the use of resources and the generation of waste and emissions. Buildings account for up to 40% of the energy use in society with equivalent levels of greenhouse gas emissions, 30% of raw materials use and waste generation and 20% of water consumption. The volume of construction activities (new construction as well as refurbishment of existing buildings) is steadily increasing all over the world with an estimated annual turn-over of more than 3 trillion US\$. Therefore, the accumulated environmental impact from buildings is substantial and the need for sustainable construction and operation of buildings is absolute. Over the last decade or so, sustainability has become a buzz word within the construction sector. There has been a rapid increase in the number of building environmental assessment methods, tools, labels and certificates, both in use and under development. This has introduced confusion, especially when comparing buildings on an international basis. Added to which, as the focus has shifted from purely environmental issues to sustainability, the difficulty increases as to how to define with certainty what an environmentally and socially responsible building is, and which indicators and measures are a reliable sign of good performance.

Rationale for this Report

The need for a common language and definition for sustainable buildings and construction is widely recognized. So far there is no global consensus, and in many countries, no basis for defining the distinctions, costs or benefits of standard and sustainable approaches to building. This can lead to ill-informed perceptions of political or financial risk which undermine efforts to fully implement sustainable building practices.

In addition there is a lack of consistency in the approach to the sustainability impacts of buildings and the consequences to their value as investment assets. Increasingly demanding environmental legislation means that there can be significant risks associated with investment in property and the financial burden associated with either upgrading performance to comply with legislation or the associated loss in value as a result of not doing so. The majority of building assessment systems created to date has focused predominantly on new construction with the assessment of buildings in use a secondary concern. However, this situation is rapidly changing as stakeholders recognize

the impact that buildings in use have on their environment and the influence this has on their investment asset value.

This report therefore aims to provide clarity on the current 'state of play' in this area. It has two key aims:

- To provide an overview of the current assessment systems and methodologies exist internationally and to summarize the issues they include with the aim of identifying a common core of issues which any such system should address.
- To provide background information enabling UNEP-FI PWG to help investors to understand the risk reduction potential of sustainable buildings and the potential differentiation in investment returns between buildings deemed to be lower or higher risk.

This report provides a shared knowledge base for UNEP SBCI and UNIP FI PWG and is planned to be further developed into targeted reports and guidance for key stakeholders. It should be noted that this is not intended as a highly technical academic report but instead is a simple guide to the current situation in the assessment of sustainability and responsible investment within the built environment.

Terms of reference

This report has been commissioned by UNEP's Sustainable Buildings & Construction Initiative (UNEP SBCI) and Finance Initiative Responsible Property Working Group (UNEP-FI PWG) and sponsored by Caisse des Dépôts et Consignations in order to deliver the following required output:

- Key principles and indicators used for defining sustainable building performance,
- Key benchmarks that qualify sustainable rather than standard building performance,
- Key financial performance indicators and benchmarks for sustainable buildings,
- The conceptual system boundaries between for example, 'green', 'sustainable', 'symbiotic' and 'regenerative' performance defined by each scheme.

Principles of sustainable buildings & construction

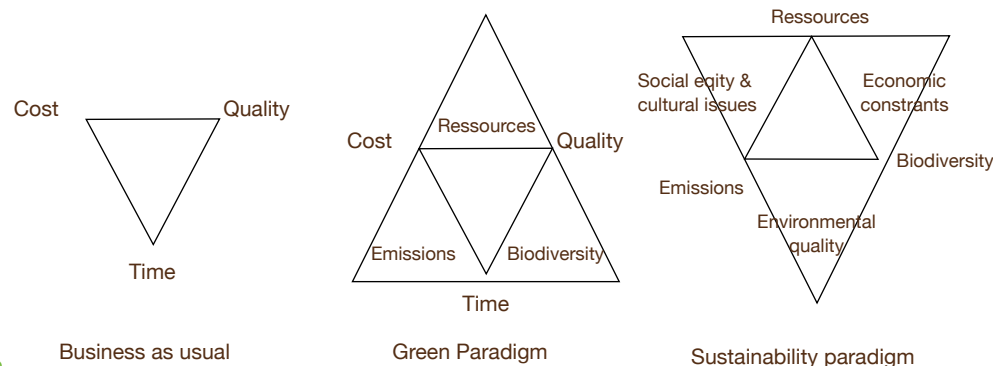
The concept of 'green building' currently is in a transition since efforts are being made worldwide to facilitate the understanding of the further development towards the broader concept of 'sustainable building'. Such a transition, however, requires that environmental, social and economic aspects are considered equally and simultaneously along with technical, functional, aesthetic and urban development issues within the scope of a variety of activities and processes ranging from planning, construction and management to valuation, risk assessment, as well as investment decision making and counseling.

Performance Definitions

The difference between sustainable and unsustainable forms of building can be distinguished by the scope of issues considered, the scale of intended influence, and the level of performance that is achieved by a building project as it addresses these issues. It is clear that it is next to impossible for a single building to live up to the full definition of environmental, social and economic sustainability, and so the most realistic expectation is that buildings with excellence in a broad spectrum of performance can help to move communities towards sustainable development.

Scope

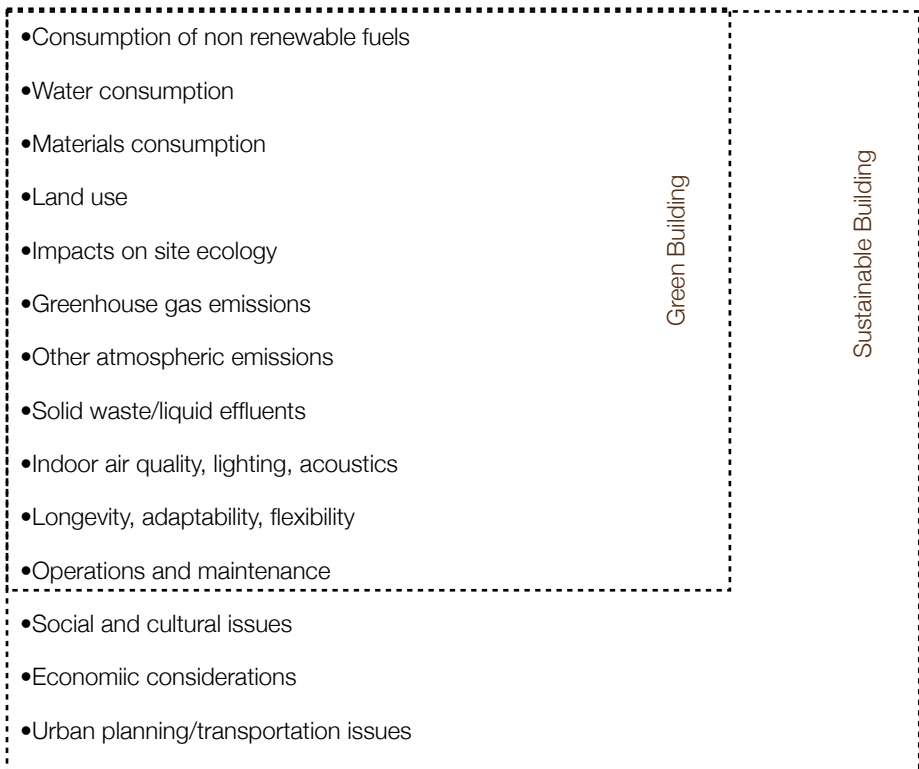
The 'business as usual' approach to building has traditionally considered the inter-related economic issues of time, cost and quality. Sustainable building projects on the other hand, attempt to broaden the scope of issues considered to include the influence on environmental, social and economic systems. Positioned between these two approaches are so called 'green' buildings, which focus predominantly on environmental performance as a defining feature of a building. The variation in scope of issues considered in 'business as usual', 'green', and 'sustainable' is shown in figure below:



Differences in Scope between BAU, Green and Sustainable Building projects. Adapted from: CIB, 1999 Agenda 21 for Sustainable Construction.

Scale

Figure above also indicates that while 'business as usual' issues can be directly addressed on individual building projects, dealing with 'green' issues requires considering the building and its supply chain over its life-span. As a project scope broadens to address sustainable development issues, the scale of the system under consideration necessarily increases again, to include for example, social infrastructure and community development. Thus, building projects must move more and more towards community-scale solutions to contribute to sustainable development as listed below.



Principles of sustainable buildings & construction

Despite the increased scope of and scale taken by sustainable building, it is possible to contribute to sustainable development with single building projects. The key is ensuring that the overall performance of the building is socially, environmentally and economically positive.

Level of Performance

The fundamental performance target for buildings is to replenish ecosystems services, promote equity and become climate neutral. UNEP's Global Environmental Outlook 4 (GEO4) shows that the health of ecosystems is in decline globally, while human demand for ecosystem services is growing exponentially (UNEP, 2008). In addition, climate change is continuing to be exacerbated by increasing greenhouse gas emissions, more than 30% of which come from buildings (IPCC, 2007). The global threat to our economies and societies has never been greater. Construction and operating the built environment has contributed significantly to this situation. Aiming to simply minimize environmental damage or social inequity is not a sustainable approach. A building that performs 'less-bad' is not good enough to address the issues we face.

On the other side of the ledger, the building sector is one of the world's largest industrial employers, and has the greatest potential of any industrial sector to deliver zero-cost greenhouse gas emission reductions (ILO, 2008; IPCC, 2007). Many governments are now harnessing this potential of the building sector to stimulate economies hit by the financial crisis by tying incentives to requirements to improve the environmental performance of buildings.

In a 'business as usual approach normally the emphasis of financial, risk and contracting requirements creates pressure to minimize project delivery time and up-front capital cost without compromising on the quality of the performance of the project in use. It is only recently that the environmental and social performance of buildings has been considered an issue. But these are still far from mainstream concerns.

The table below provides one view of the relationship between levels of performance that commonly distinguish approaches to building. These range from Regulatory (or 'business-as-usual') levels, to 'good practice', 'green', 'sustainable' and 'regenerative'. One of the messages embedded in this categorization of performance is that an increasingly broader view must be taken, as performance levels rise. Thus, sustainable building approaches must consider social and

economic issues, as well as those relating to scale. For the sake of simplicity, the scales referred to in this table are confined to those relating to either 'buildings' or 'community'.

Goals	Community scale	Building Scale
REGENERATIVE Bring ecosystems back to full health	To be explored	
SUSTAINABLE No negative impact on ecosystems	Very little use of vehicles, pedestrian oriented, green space	Very high performance, feed electricity to grid
GREEN Substantial improvement in environmental performance	Emphasis on higher densities, mixed uses, control of car, provision of public transport	
GOOD PRACTICE Substantial improvement in environmental performance	Community planning follows conventional suburban path.	Performance levels achieved by top 25%
REGULATION Minimum performance according to regulation and/or industry practice	Transport, water, sewer etc. seen as quite separate	Some emphasis on energy performance, but not much else

Common Performance Indicators for sustainable building

SB performance issues and impact categories must span a wide range of issues. It is also important that they are specific enough to provide a meaningful assessment of performance in each case. In this regard it is important to maintain a clear distinction between design features, performance issues (e.g. greenhouse gas emissions or adaptability) and eventual impacts (e.g., climate change or occupant health) whether environmental, social or economic.

Principles of sustainable buildings & construction

To clarify these distinctions a detailed analysis of the environmental issues and indicators covered in the world's most well-know building environmental rating schemes has been conducted (see appendix for details).

This table defines those issues covered by five or more of the systems with those issues covered in all six systems highlighted in bold :

Action/Step	Community scale
Greenhouse gas emissions	Use of non renewable primary energy-building
	Monitoring of energy- building
	Use of renewable primary energy
Acidification and osone destruction	Destuction of the stratospheric ozone layer
Mitigate impact on site ecology	Mitigating impact on existing site ecology
Enhance site ecology	Enhance native plant/animal species
Materials consumption	Depletion and use of renewable and non renewable resources (other than primary energy)
	Responsible sourcing of major building elements/ operation materials
Water consumption	Use of freshwater ressources
Land consumption	Re-use of previously developed site
	Minimizing regional specific climatological risk e.g. flooding
Building user comfort	Lighting & visual comfort
	Thermal comfort
	Ventilation conditions
	Acoustic comfort
	Occupant satisfaction

What is instantly apparent from this analysis is that the majority of the sub-issues covered by all of the systems are either classified as environmental (i.e. those relating to greenhouse gas emissions, water consumption etc) or could be considered quasi-environmental (i.e. those relating to building user comfort, accessible public transport etc) in that they have a combined social and environmental impact.

These findings should be confronted with the efforts currently undertaken to standardize the description and assessment of the environmental performance of buildings: in Europe under CEN/ TC350, and at the international level under ISO TC 59 SC 17 (see appendix for details).

It is also interesting to replace these results within the context of the global economy to appreciate the importance of each category in the global GHG emissions production.

Furthermore, because financial and social issues are not well represented in these rating schemes, a combination of strategies is necessary when pursuing a sustainable approach to building development.

Whether an activity is sustainable or not depends on the resilience and adaptive capacity of the supporting environment. To keep it simple, a sustainability indicator should be able to measure the amount of damage avoided such as CO2 emissions avoided or sequestered; or the amount of benefit produced such as habitat creation, water purification or renewable energy production.

A sustainability indicator can also measure distance to a target level of performance such as 'zero-net energy' consumed or sustainable development goal such as number of jobs created.

Key Financial Indicators for sustainable buildings

This section has the following objectives:

- I. To describe the basics for evaluating and assessing the economic advantages and financial performance of sustainable buildings as well as identifying the key financial performance indicators required for this purpose;
- II. To discuss the possibilities for developing and applying appropriate benchmarks for comparison and continuous improvement;
- III. To highlight the methodological and conceptual difficulties when assessing and reporting two of the key financial measures which are of relevance for all almost all actors in property investment markets: risk and value.

The possibilities for developing and applying appropriate benchmarks are also addressed. Both the choice of indicators as well as the discussion on approaches for appropriate benchmarks is focused on taking into account the specific interests and goals of private and institutional investors, fund managers as well as banks and insurance organisations.

The economics of sustainable buildings

In general, sustainable property investment products qualify by following one or more of these four generic strategies:

- I. Purchase and/or disposal of property assets that meet/don't meet predefined environmental and social performance requirements;
- II. Investments into new building projects that are designed, constructed and subsequently managed according to the requirements of sustainable buildings;
- III. Investments into the existing building stock in order to systematically improve sustainability performance; and,
- IV. Investments into community projects such as affordable housing and urban revitalisation in order to foster a more sustainable society.

Similarly as with single buildings, sustainable property investment products (e.g. 'green' REITs, closed-end funds, etc.) can create beneficial effects which are to be taken into account when describing and assessing their financial performance :

- Similar or better risk-return ratio compared to conventional property investments
- Very high attractiveness for SRI-interested investors
- Improved stability of value and higher value growth potential

However, sustainable property investment products are more than just a set of sustainable buildings. In addition to the positive characteristics and attributes of the building within the property portfolio, sustainable property investments qualify through the following issues:

- Active portfolio management which adheres to the principles of sustainable development
- Inclusion of sustainability issues within the product prospectus
- Inclusion of sustainability issues within the annual report

The compliance of a property investment product with the principles of sustainable development or with the principles of Socially Responsible Investing respectively can – for the moment – be described, assessed and communicated by making use of a combination of labels and certificates (see appendix for more detailed information) and by checking compliance with SRI standards like the Global Reporting Guidelines and the Principles for Responsible Investing. Stand-alone labels and certificates for assessing the sustainability of property investment products do not yet exist.

Groups of actors, their roles and interests

An evaluation of buildings' or property investment products' advantageousness or superiority can always only take place within a specific context of a selected group of actors and their respective role, views and interests. As a consequence, the choice of appropriate indicators and benchmarks depends on (and is influenced through) the individual actors' goals and attitudes, so as on their perception of, and attitude towards risk. But also on their time horizon as well as their preferred methods and procedures for measuring (financial) expenses and benefits. Each of these influencing factors can be different not only between groups of actors, but also within a single group of actors.

Key Financial Indicators for sustainable buildings

For example a bank or financial institution can act as a financier of property assets for third parties, awarding authority and investor for self-occupied assets, tenant, landlord, buyer and seller, asset and fund manager, investor / trader of shares in indirect property investment products, etc. Consequently, clearly distinguishing between groups of actors and their roles is almost impossible. However, the following key roles can be distinguished and it has to be noted that businesses, corporations and other actors in property and construction markets can and do take a variety of roles at the same time.

Individual and institutional investors with medium- to long-term interests

These usually have an interest in a stable investment performance on the basis of a stable property cash-flow in combination with stable asset values or a moderate, positive development of value respectively. This usually goes hand in hand with an interest in minimising short- and long-term financial risks.

Individual and institutional investors with short-term interests

These usually have an interest in fast value enhancement in combination with the minimisation of short-term financial risks.

Project Developers

These are usually interested in fast sales and marketing successes in combination with high profit margins and the minimization of short-term financial risks.

Landlords / awarding authorities and buyers of rental assets

These usually have an interest in low construction or purchasing costs, a stable property cash-flow in combination with stable asset values or a moderate, positive development of value respectively. In addition, they

Sustainable property investment can be defined as “investing in pursuit of sustainability, or, to be more precise, as investing in pursuit of greater durability, adaptability, usability and efficiency of buildings and the building stock, leading to enhanced productivity, well-being, and economic benefit measured in terms of financial, natural, manufactured, human and social capital” (Lorenz et al., 2008, p. 8).

usually are interested in short marketing periods, low vacancy rates, low risks of losing existing tenants, low maintenance costs, high rental levels and a long usability/lettability of their assets. In order to safeguard these goals there is a general interest in minimizing short- and long-term financial risks.

Awarding authorities and buyers / owners of self-occupied assets

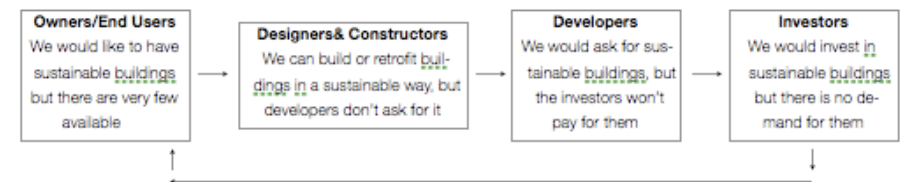
These have a particular interest in realizing their specific user requirements while at the same time usually focusing at low construction and/or investment costs, low operating costs and thus low life-cycle costs. At the same time, there usually is an interest in stable asset values or a moderate, positive development of value respectively.

Tenants

These have a particular interest in realizing their specific user requirements at low rental costs and a low share of operating costs attributable to them.

Financers

In the case of project financing they usually have an interest in the property asset's current market value (in some world regions an estimation of mortgage lending value is preferred for loan securing appraisals) as well as in low financial risks during the duration of the loan.



Fund managers

These are usually interested in an outstanding investment performance and they use this measure as an indicator of success. Depending on the fund's strategy there may also be an interest in

Key Financial Indicators for sustainable buildings

realizing short-term benefits of increase asset values. Risks are to be minimized through an active fund management – thus, there is an interest in minimizing short-, medium- as well as long-term financial risk but also in an early detection of potential risks.

Society

Besides society's interests which are usually represented and pursued by governments, all actors in property and construction markets are part of society and may therefore have an interest in reducing external costs (as well as in maximizing public health and well-being as these issues are likely to link back to business climate and organizational success in general). However, the possible financial indicator 'external costs' will not be further discussed here due to the complexity of the issue and diverging perceptions regarding the definition and measurement of society's external costs.

When considering groups of actors in property markets in relation to key performance indicators and benchmarks for sustainable buildings the discussion has to take a wider scope and move beyond mere single actors and their individual interest. This is because property and construction market actors are in dialogue, they are interconnected and there are various information flows between them. For example, when a bank considers granting favourable financing conditions for a sustainable building, the bank will have to rely on information describing the respective building's sustainability performance, so that a decision can be made whether or not the risks associated with that loan can actually be considered lower, if compared to a loan for a conventional building. This information may either be delivered by the borrower himself or may be provided by external experts.

In any case, an information demand exists which cannot be appropriately satisfied at the moment. The problem is twofold: First, information on buildings' sustainability performance is not yet readily available; and second, the necessary information flow between the key actors in property and construction markets is neither organized nor standardized.

Breaking the Circle of Blame

The results of missing information and unorganized information flows between actors in property and construction markets can best be exemplified by referring to what has become known as the

vicious circle of blame which describes a misalignment between suppliers and those demanding property assets for occupation and/or investment. Apparently, this misalignment will remain if the informational basis that actors have to work with, the information links and the feedback structure within the property and construction industry remain unchanged.

Consequently, it has been argued that installing appropriate feedback mechanisms is the fundamental condition for breaking the vicious circle of blame. For this to happen, everyone involved needs to be provided with appropriate feedback on both the environmental and social aspects of building performance as well as on its various interrelations with financial performance. In this regard, the traditional focus on the construction part of the entire process has certainly been helpful but not sufficient. The interplay between all the different actors as well as the information flow needs to be organized in such a way that the knowledge on the benefits of sustainable buildings pervades all areas and is accounted for within the highly influential sphere of property investment and finance (see: Hartenberger and Lorenz, 2008). This, however, requires:

- Identifying and defining key financial performance indicators for sustainable buildings;
- Using appropriate methods and technologies for collecting the necessary data;
- Obtaining permission of owners to use data;
- Developing and applying appropriate benchmarks for comparison and continuous improvement;
- Applying multi-dimensional decision support instruments; and
- Establishing templates for displaying data and performance reporting.

The challenge here lies not in inventing new performance indicators and methods for financial performance measurement but to adjust and fine-tune measurement methods and benchmarks for those indicators the actors in the system are already working with and to link them to the dimension of physical and technical performance measurement of buildings. This will allow quantifying and expressing the linkages between environmental, social, and financial performance of buildings and may also allow for a more profound and faster understanding of the root causes of financial performance variations.

Key Financial Indicators for sustainable buildings

Performance Measurement: setting Indicators and Benchmarks

The concept that performance matters is fundamental to setting indicators and benchmarks as there is common feeling that what is not measured cannot be controlled, influenced and improved. Organisations engage in performance measurement for a number of different reasons (some of which are summarised in the table below) which can fall under four main categories:

- To check position
- To communicate position
- To confirm priorities
- To drive progress

Key performance indicators (KPIs) are metrics (financial and non-financial) that are used by organizations and individuals to check compliance with stated requirements or to define and measure progress towards stated goals or objectives. Consequently, a KPI can be described as a “key part of a measurable objective which is made up of a direction, a target, a benchmark and timeframe” (Jones and White, 2008). For example, ‘reduce operating costs per square foot by 15 % by financial year end 2009’. In that case, operating costs per square foot is the KPI.

Why we measure performance ?	Check position	Communicate position	Confirm priorities	Compel progress
To establish position	✓			
To monitor progress	✓			
Because the organization has to	✓	✓		
Because the organization wants to communicate performance to shareholders or costumers		✓		
Because the organization or others want to be able to benchmark performance		✓	✓	
Because measures stimulate interest		✓		✓

Why we measure performance ?	Check position	Communicate position	Confirm priorities	Compel progress
Because measures can be used to communicate priorities		✓		✓
Because measures provide a means of motivating people to look for ways of improving performance				✓
Because measures provide a basis for reward				✓
Because measures provide a means of management control	✓			
Because measures provide a means of cost control	✓			
Because measures provide an insight into what is important for the costumer	✓		✓	
Because measures provide an insight into what the business is doing well	✓		✓	
Because measures provide an insight into what the business is not doing well	✓		✓	
Because measures provide an insight into what the business needs to focus on			✓	
Because measures provide an insight into where the business should invest			✓	

KPIs can vary significantly depending on the purpose and context in which they are used. In addition to that, the research and literature available on performance measurement is vast and abundant. For example, Neely (1998) reported that between 1994 and 1996 alone, one new paper or article on the topic appeared every five hours of every working day. However, when it comes down to the process of identifying an defining KPIs the acronym SMART is often used which stands for some key rules to consider; so KPIs should be:

Key Financial Indicators for sustainable buildings

- Specific and Significant
- Measurable and Manageable
- Accurate and Available
- Relevant
- Time specific.

Usually, key performance indicators are embedded within performance measurement and benchmarking systems. This is particularly true within the corporate real estate management (CREM) process which primary task is to “provide approaches and tools that facilitate the formation and maintenance of a feedback loop between real property performance across the portfolio and managerial action” (Bon et al., 1995). Also within the construction industry a wide number of different performance measurement models have been developed through the years. However, dwelling on the subject of performance measurement models in property and construction in detail lies beyond the scope of this publication; in addition to that, this has been done elsewhere (e.g. in Beatham et al., 2004; Kishk et al., 2005; and Jones and White, 2008). Instead, the focus here lies more on financial key performance indicators for buildings that are in use within property and construction related performance measurement systems but which are currently seen most of the time not within the context of sustainable development and its wide-reaching implications.

What has to be emphasized, however, is the role of benchmarking. Benchmarking can be described as a process of continuous improvement based on the comparison of an organization's and/or asset's performance with other organizations' and/or assets' performance. On an organizational level benchmarking can be carried out either internally, within the same industry or across other industries and sectors. Comparison is often made with what has been identified as best practice. In any case, without benchmarking one does not know where one stands. For this reason, “benchmarking is key to adding value to performance measurement” (Beatham et al., 2004, p. 97).

When identifying and defining key performance indicators for buildings three different performance levels can be distinguished; these are: financial performance, occupational and organizational performance; as well as physical and technical performance. What becomes clear from the figure below is that in most of the time financial indicators are lagging indicators. Of course, measuring financial indicators is important and necessary for the reasons explained above and because these performance metrics determine the success or failure of an organization or property investment respectively. However, financial indicators, or, to be more precise their isolated measurement and analysis very often does not really help to react on time. *“They do not show what specifically went right or wrong nor help us clarify what needs to be done to improve. What we desperately need is a way to measure inputs or those things that lead to favorable outcomes”* (Denton, 2005, p. 282). In the case of buildings this lies, amongst other issues, in the realm of measuring physical and technical aspects of building performance.

Key performance indicators and benchmarks for buildings can further be distinguished according to :

1) Suitability and applicability for

1.1) single buildings / direct property investments
(e.g. additional construction cost)

1.2) property investment products / indirect property investments
(e.g. total return)

2) Type of indicators and benchmarks in the sense of

2.1) direct indicators and benchmarks on the basis of monetary and/or financial measures
(e.g. risk-return ratio, life-cycle-costs)

2.2) indirect indicators and benchmarks on the basis of non-monetary measures
(e.g. usability by third parties, flexibility)

Within the remaining part of this section the focus clearly lies on direct indicators and benchmarks for single buildings / direct investments as well as for property investment products / indirect

Key Financial Indicators for sustainable buildings

investments. Indirect indicators and benchmarks based on non-monetary measures are the subject of the other parts of this publication.

Figure below gives an overview on the key financial indicators that will be explained and discussed in the following. In addition, it is shown which indicators are of particular relevance and interest for the different groups of actors.

Before the indicators and benchmarks will be addressed in more detail it has to be noted that questions relating to the development and application of indicators for describing and assessing economic aspects of sustainable buildings still are the subject of scientific discussion and also of standardization activities in the area of sustainable buildings at the international (e.g. ISO TC 59 SC 14 and SC17) and European (e.g. CEN TC 350).

Financial indicators review

Risk return ratio

Suitability

- Private investors
- Institutional investors
- Asset managers
- Fund managers

Applicability

- Indirect investments (property funds, REITs, etc.)
- Direct investments (in theory only)

Explanation

Investors and third parties acting on their behalf have an interest in the risk-return ratio of investments. Amongst other issues the preferred risk-return ratio depends on the attitude towards risk (from risk-avers, to risk-neutral to venturesome), the investment strategy (growth- or value-oriented) and the time horizon (short, medium, long-term). In any case, the goal usually is selecting investments with higher return at the same level risk or with lower risks at the same return.

In the of property investments, a sustainable investment with a risk-return ratio comparable to that of a conventional investment would have to be preferred.

It remains to be seen if investors are willing to accept a more unfavorable risk-return ratio due to outstanding sustainability performance.

Benchmark

As benchmarks for evaluating investments into sustainable property investment products the following measures may apply :

Actors & their roles	Indicators of interest							
	Risk return ratio	Investment performance / Total return	Construction cost / Additional construction cost	Life cycle cost / total cost of ownership / Full cost	Level of operating costs non attributable to tenant	Rent Level	Value/Stability & development of value	Risk asset specific
Individual & institutional investors with medium to long term interests	✓	✓		✓			✓	✓
Individual & institutional investors with medium to short term interests	✓	✓					✓	✓
Project developers			✓			✓	✓	✓
Landlords / awarding authorities and buyers of rental assets		✓	✓	✓	✓	✓	✓	✓
Awarding authorities and buyers/ owners of self-occupied assets			✓	✓			✓	✓
Tenants					✓		✓	
Financiers	✓	✓	✓	✓		✓	✓	✓
Fund managers	✓	✓		✓	✓	✓	✓	✓

Key Financial Indicators for sustainable buildings

- Risk-return ratio of alternative investments

(e.g. green REIT vs. stocks and bonds / full investment universe)

- Risk-return ratio of alternative property investment options

(e.g. green REIT vs. closed-end property fund)

- Risk-return ratio of comparable property investment option

(e.g. green REIT vs. conventional REIT)

In particular, the comparison with investment options within the same group of investment products seems particularly helpful. The risk-return ratio of the sustainable option should be similar or better compared to a conventional investment option.

State of things in research & practice

Research on the comparison of risk-return ratios between property as an asset class and other investment classes such as stocks and bonds has been regularly published. However, concerning the risk-return ratio of sustainable property investment options the literature is sparse.

Investment performance / Total return

Suitability

- Private investors
- Institutional investors
- Fund managers, investment advisor, banks
- Rating agencies

Applicability

- Green REIT
- Other stock listed property investment vehicles

Explanation

Most investors, managers and rating agencies use a measure of the investment's performance or total return for evaluating that investment's economic success. This is usually linked to the comparison of the performance of some kind of base-index. The total return (or Rate of return) of an investment indicates cash flow from an investment to the investor over a specific period of time, usually a year. It is a measure of investment profitability, not a measure of investment size.

Benchmark

As benchmarks for evaluating investment performance various measures can apply; e.g. overall indexes (such as NASDAQ) or property specific indexes (such as the RX REIT Index).

When applying such benchmarks the standards and rules of the Global Investment Performance Standards (GIPS) are to be taken into account – see also www.cfainstitute.org.

State of things in research & practice

A comparison between the investment performance of conventional and sustainable investments has been frequently carried out in the area of SRI-products (socially responsible investments) – within the SRI-arena such research has led to the insight that economic success is now intrinsically linked to environmental and social performance. Unfortunately, similar research on the performance of sustainable property investment products does not yet exist.

Construction cost / Additional construction cost

Suitability

- Investors / awarding authorities (direct investments)
- Banks in connection with financing / loan securing processes
- Project developers

Applicability

- Direct investments

Key Financial Indicators for sustainable buildings

Explanation

Within the property and construction industry the investment or construction costs still have major importance. Although – from a methodological point of view – the focus on assessing life-cycle costs / full costs of ownership should be preferred, many decisions are based on an evaluation of construction costs.

In recent years many studies have shown that there are great uncertainties and distorted perceptions among market participants regarding the construction costs of sustainable buildings. Very often, market participants stick to the commonly held misbelief that design and construction of sustainable buildings leads to considerable additional construction costs of up to 30 %.

Benchmark

Statistical measures and average investment / construction costs can serve as a benchmark. This information is available within the different countries in various forms and for specific building types. In addition, average construction costs are further classified according to overall quality standards and different levels of equipment and fittings.

When using such benchmarks it is very important that only such figures are used that apply to the specific building type and usage of the property under investigation. At the same time it is important to pay attention to comparability of considered cost groups, manner of treating taxes as well as to the temporal validity of average cost figures.

The authors recommend using a benchmark of 0 -5 % of additional construction costs for sustainable office buildings as an acceptable range.

State of things in research & practice

Within several comparative studies the construction costs / additional costs for sustainable buildings have already been investigated. A problem in this regard still is the agreement on comparable / reference building solutions as well as the consideration of heavily fluctuating construction costs.

Life cycle cost / total cost of ownership / full cost

Suitability

- Investors / awarding authorities – owner occupiers
- PPP/PFI-Project participants

Applicability

- Single buildings
- Construction Works

Explanation

The estimation and systematic reduction of life-cycle costs is closely connected to the implementation of sustainable development principles within the property and construction sector.

Life-cycle costs are currently discussed with the scope of international standardisation ISO TC 59 SC 17) as well as within European standardisation activities (CEN TC 350) as an indicator for the economic dimension of sustainability (see appendix for more detailed information).

Benchmark

Statistical measures on average operating and life-cycle costs can serve as a benchmark.

This information is available within the different countries in various forms and for specific building types. In addition, average operating and life-cycle costs are further classified according to overall quality standards and different levels of equipment and fittings.

When using such benchmarks it is very important that only such figures are used that apply to the specific building type and usage of the property under investigation. At the same time it is important to pay attention to comparability of considered cost groups as well as to the temporal validity of average cost figures.

State of things in research & practice

Key Financial Indicators for sustainable buildings

On an international level manner and scope of life-cycle-cost calculation procedures are still heavily discussed and are partly carried differently across single countries or regions. Real Benchmarks on building life-cycle costs are only published occasionally.

Level of operating costs attributable to tenants

Suitability

- Institutional Tenants
- Private Tenants

Applicability

- Single Buildings
- Single Units

Explanation

For tenants the share of operating costs attributable to them is – besides the net rent – an important financial indicator that plays a significant role within the decision whether or not to rent a particular building or unit. It can be assumed that within a sustainable building the share of operating costs attributable to tenants is below average. While it is true that the level of operating costs is strongly influence through occupants' behaviour it is also true that a buildings energetic quality has an impact on heating costs, water saving installations and fittings have an impact on costs for water and waste-water; and intelligent solutions for waste separation do impact on costs for waste disposal. However, it also has to be noted that highly sophisticated, technical building solutions may lead to a rise in maintenance costs. In any case, with rising energy costs tenants start seeing the net-rent as well as their operating costs as one “rental cost factor”. As a consequence, the level of operating costs bearable by the tenant affects the property's competitiveness. In buildings with lower operating costs attributable to tenants, landlords may have the opportunity to adjust net rents accordingly. This is also true within the scope of modernisation and refurbishment. In addition to that, tenants may gain from increased comfort at the same level of the gross rent.

Benchmark

As a benchmark national and regional occupational cost indexes can be used. These are published in many countries. For example, in Germany they are published by tenant unions/ associations. Although these indexes do not have the same legal significance as rental indexes they do offer a good basis for comparison.

Due to national and regional differences as well as fast changing prices for single cost categories it is important to consider the timeliness as well as the spatial validity of the comparative data. In addition, there may be differences in the treatment of value-added taxes as well in the chosen reference unit (e.g. net floor area or living area, etc.). Also, national differences in rental law and practice are to be taken into account as these differences my impact on whether certain cost categories are attributable to tenants or landlords..

State of things in research & practice

Indicators and benchmarks can be used in practice without any difficulties. At the moment, the application of benchmarking systems is currently developing into business models and/or is already offered as a professional service in many countries.

Level of operating costs non-attributable to tenants

Suitability

- Landlords
- Fund managers

Applicability

- Single Buildings
- Single Units

Explanation

Key Financial Indicators for sustainable buildings

Besides the investment- or capital costs the level of operating costs non-attributable to tenants link through to the profitability of rented assets. In addition to that, they impact on value as these costs are taken into account by property valuers when estimating market value within the scope of the investment/income approach. Usually, these costs are influenced through the maintenance and repair costs.

Sustainable buildings may not cause lower maintenance and repair costs automatically as these costs are strongly influenced through the structural and technical building solution. However, if an appropriate structural and technical building solution has been adopted, maintenance and repair costs are likely to be lower compared to conventional assets. .

Benchmark

Benchmarks for maintenance and repair costs are rarely available. However, they do exist in the form of internal organisational benchmarks (e.g. within housing and property companies). Benchmarks on the basis of should-be / demand values or calculated values can also be constructed. When using such a benchmark the following issues may have to be taken into account: timeliness, spatial validity, applicability for different types of assets and uses, chosen reference unit as well as the treatment of value-added taxes.

State of things in research & practice

In research & practice. The research on this issue is sparse. Some housing and property associations or other interest groups develop internal benchmarking systems. Usually, these are neither published nor accessible.

Rent level

Suitability

- Landlords
- Fund managers

Applicability

- Single Buildings / single units
- Groups of buildings / portfolios

Explanation

In combination with operating, maintenance and repair costs the current rent level determines the profitability of an asset. It also determines, amongst other issues, the current market value of income producing properties. Of particular interest is if higher / above average rent levels can be achieved in sustainable buildings. Due to sustainable buildings' characteristics and attributes and due to changes in market participants' preferences it is likely that this is the case. However, analysing the impact of sustainability features on rent levels requires that the many other effects which impact on rent levels are appropriately accounted for. This can be done by making use of hedonic pricing techniques. There exists a conflict of goals as well. Landlords might want achieving maximum rent levels within their buildings. However, one of the many goals of sustainable development is that housing space is available at affordable rents.

Benchmark

As a benchmark a national or local rent index for comparable properties can be developed. When using such a benchmark the following issues may have to be taken into account: timeliness, spatial validity, applicability for different types of assets and uses, chosen reference unit; the treatment of value-added taxes as well as local/regional particularities in rental arrangements.

State of things in research & practice

This indicator and benchmark is applied in practice. Similarly as with the analyses of observed prices, quantifying the impact of sustainability issues on rents is difficult due to deficits in the description of property assets and problems in obtaining comparable data. However, first research studies do exist which come to the conclusion that sustainable buildings outperform their conventional counterparts.

Value / Stability & Development of Value

Suitability

Key Financial Indicators for sustainable buildings

- Owners / Investors, Landlords, Fund managers, Financers
- Single Buildings / single units
- Groups of Buildings / Portfolios

Explanation

The current value (market value) of a property asset is of interest for almost all actors. Its development or stability respectively is one of the key financial performance indicators. However, the market value figure of an asset is always based on an estimate made by professional valuers / appraisers. Estimating the market value of property is a difficult exercise which is made even more difficult due to the challenges imposed by sustainable development (see the following chapter on risk and value). Any estimation of market value can only be verified when the respective asset has actually been sold in the market place. But then, it has to be taken into account that price and value are not necessarily the same (even if the terms are often used as if they were synonymous) since a sale might have taken place under special circumstances. In any case, the stability and development of value can only be analysed and used as a performance indicator over time if the respective asset(s) are valued on a regular basis. It is now generally assumed that sustainable buildings should receive higher estimates of market value. A special form of analysing the development of value takes place in connection with modernisation and refurbishment activities. Here it is of particular interest to see the value enhancement effect of such activities.

Benchmark

A benchmark can be constructed by defining a baseline value or range of values under which the current market value shall not fall. Also it is possible to define a desired rise in value and to express this as a percentage figure. Another form of benchmarking is to compare the development of value to the development of prices observed for actual transactions of similar assets / asset classes or within the same sub-market.

State of things in research & practice

This indicator and benchmark is applied in practice; new accounting standards also do facilitate that assets are valued on a regular basis. The key problem here is that researchers and

practitioners do not yet know how to adjust valuation input parameters to reflect sustainability issues in estimates of market value. This is due to the circumstance that the relationship between observed prices and sustainability features cannot yet be appropriately analyzed due to deficits in the description of property assets within transaction databases. This is a major problem and will be discussed in more detail below.

Risk asset specific

Applicability

- Investors
- Financers
- Fund managers

Suitability

- Single buildings

Explanation

Risk is an important indicator as any property investment decision involves taking into account the risk associated with that investment; taking into account property specific risk may either take place implicitly or expressed by making use of one of the various risk measures. In financial models the risk associated with an investment is expressed in terms of variance in actual returns around an expected return. Hence, an investment can be regarded as riskless when actual returns are always equal to the expected return. However, using financial models and metrics in order to measure and express property specific risk is not fully feasible due to data limitations (see Lorenz et al., 2007). For this reason, so-called rating or risk-scoring techniques are used in order to measure and express risk in the property and particularly in the property finance sector. Due to the characteristics and attributes of sustainable buildings it is expected that they exhibit lower risks than their conventional counterparts. However, quantifying this relationship is difficult (see the following section on risk and value).

Benchmark

Key Financial Indicators for sustainable buildings

As a benchmark the risk or risk-score attributed to comparable assets or to competing investment alternatives can be used. Risk-scores can also be compared over time in order to detect whether or not the risk of a completed investment is actually rising or falling. When using such benchmarks the timeliness as well as the spatial validity has to be taken into account.

State of things in research & practice

Risk-scoring and benchmarking systems for property assets are widely applied in practice and are currently being further developed. However, major difficulties exist in taking into account the impact of sustainability issues on risk and to reflect this within the rating system. A rating approach that already takes into account certain sustainability-related rating criteria has been developed by the The European Group of Valuers' Association (TEGoVA). This rating approach has been very influential and has been the basis for several rating system now applied within the German banking industry.

On risk & Value

The notion of «Risk»

As noted above some of the financial performance indicators described here may be more important to a particular group while having less significance for another group of actors. Also, there are other financial indicators that may be used within performance measurement systems in relation to sustainable buildings (e.g. vacancy rates and CO₂-avoidance costs, etc.). However, there are two financial metrics that have relevance to almost all groups; these are risk and value as most actors require an estimate of value and an assessment of risk for one reason or another. The challenge is that their measurement or estimation processes are not as straightforward as for many of the other indicators mentioned in the previous section. This is due to the complexity of the underlying concepts.

Within the research literature Risk is sometimes confused with Uncertainty. The terms are often used interchangeably and one can often be found within the description of the other. Therefore, a brief clarification seems appropriate:

Popular risk measures are 'value at risk', 'probability of default' or 'beta-coefficients'.

Some authors suggests that Risk cannot be defined operationally but only intuitively as definitions of Risk are likely to carry an element of subjectivity depending on the nature of the Risk and to what it applies to. Following Adams, one could argue that 'risk is a word that refers to the future. It has no objective existence. The future exists only in the imagination.' Thus, risk is all in the mind.

As an alternative, the interpretation of Risk provided by Chicken and Posner (1999) is particularly useful and is also better suited to express the concept of Risk associated with single buildings: Instead of defining Risk, Chicken and Posner define the *constituents* of risk:

$$\text{Risk} = \text{Hazard} \times \text{Exposure}.$$

Whereby hazard is the way in which a thing or situation can cause harm while exposure is the extent to which the likely recipient of the harm can be influenced by the hazard. With a focus on property, harm is meant to be loss of income (cash-flow) and capital (capital value) while exposure involves the notions of frequency and probability.

The problem with the description and quantification of risk associated with single buildings is that conventional risk measures from the finance and investment sectors often cannot be applied in practice as the necessary distributions of returns are usually not available and due to deficits in the description of property assets and their performance within property transaction databases and indexes.

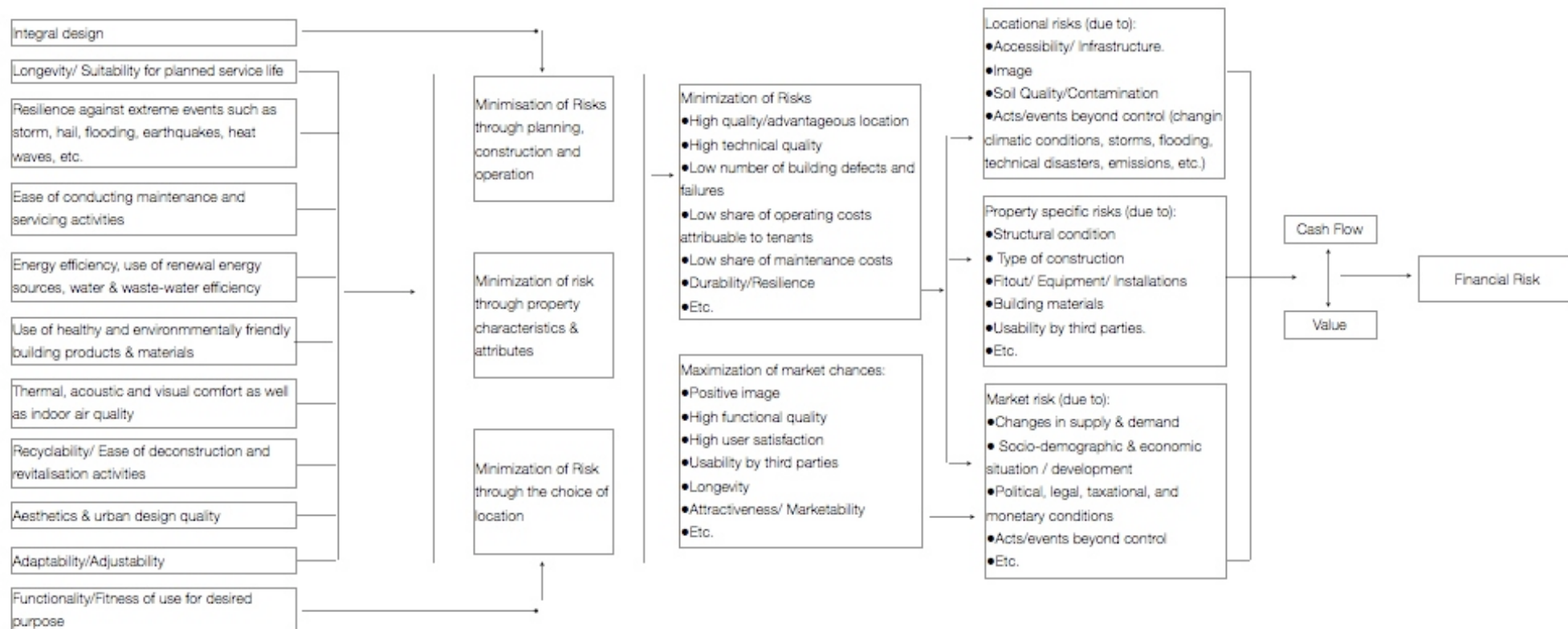
In addition, conventional risk measures such as the standard deviation often provide only a limited view of Risk. For this reason and as noted above, so-called rating or risk-scoring techniques are used in order to measure and express Risk in the property and particularly in the property finance sector.

Rating is not a new concept; it has been used since the beginning of the 20th century by companies like Moody's and Standard & Poors in order to provide information on the financial strengths and willingness of companies to comply with liabilities completely and in time (TEGoVA, 2003). During the last years several property rating or risk scoring techniques have been developed within the property and finance industry. Some of these rating systems already do take into account sustainability issues (for an overview, see Lützkendorf and Lorenz, 2007). They usually contain several main criteria classes (such as market, location and property); several levels

Key Financial Indicators for sustainable buildings

of sub-criteria classes as well as rating scales that usually range from 1 (excellent) to 10 (disastrous). In order to refer to the interpretation of risk outlined above, the rating criteria or indicators represent potential hazards which can cause harm (loss of income and/or value) while the rating scale represents the perceived level of exposure to which the property investment can be influenced by the hazards. The overall risk score or rating results then represents a highly aggregate view on the risk associated with the building under analysis.

A deeper analysis of current property rating and risk scoring systems reveals that they have a considerable number of building related physical and technical indicators (such as energy efficiency, use of healthy construction materials, etc.) at their core which link through to the overall rating result. The basic idea is conceptualized in the following Figure (Lützkendorf/Lorenz 2008).



Key Financial Indicators for sustainable buildings

Developers of property rating systems (mainly banks and rating agencies) have started creating links for the direct and indirect integration of sustainability issues within rating methodologies and processes. If applied properly, this may have wide-ranging implications on financing and investment decisions in general, on interest rates as well as on the property valuation and underwriting process. Regarding the latter, the highly influential and sensitive processes of determining the risk premium for capitalization and discounting purposes will arguably be affected.

At the moment, the use of existing property ratings already allows distinguishing more clearly between conventional buildings and more sustainable ones (Lützkendorf and Lorenz, 2007). However, if the results of building assessment tools are to be used to support the rating process, then the flow of information can be organized in different ways and the question arises whether partial results of building performance assessments should be used to provide the informational basis for certain aspects of property ratings, or if the overall building assessment result should be integrated into property ratings as a separate rating category.

In any case, if financial intermediaries acknowledge the economic impact of sustainable design, such acknowledgment will be credible in the longer term only if the sustainability performance of a building is reflected in the lending terms. Some banks are already offering special lending terms for energy-efficient, environmentally sound and/or sustainable buildings. However, there is a need to verify whether this is the result of marketing activities or certain grants-in-aid, or whether it is in fact due to a better understanding of the correlation between risk assessments and lending terms? Only in the last case would this represent a breakthrough with wide-ranging implications. But such conclusions can be drawn only on the basis of data combining performance-based building descriptions on the one hand and financial performance information (in this case: financial losses and loan default rates) on the other hand.

The notion of «Value»

The value of something consists in its recognized fitness for attaining an end, or in its recognized utility. In the property world several definitions of value exist; these serve as the underlying basis for professionals when carrying out valuation work. The two fundamental definitions of value are Market Value (i.e. exchange value) and worth (i.e. use value). Worth is defined as the value of the property to a particular investor, or class of investors, for identified investment objectives. In this context an investor includes an owner-occupier (RICS, 2003). Or expressed in other words, worth

is the maximum/minimum capital sum an individual would be prepared to pay/accept for an asset. However, whether the individual is considering investment or occupation will have consequences for the calculation of worth. An investor's view of worth can be described as the discounted value of the cash flows generated by the property whereas the owner-occupier regards the property as a factor of production. Thus, the owner-occupier's view of worth depends on the property's contribution to the profits of the business and, and thus also on issues such as image, identity and other personal preferences. However, both groups will also be mindful of the property's potential resale price to a purchaser from the other group. In any case, the calculation of worth requires investor or client specific inputs. If these inputs comprise the investor's or client's wish to take advantage of the benefits of sustainable buildings, to mitigate the risks and costs associated with increasingly stringent environmental legislation and to implement Socially Responsible Investment policies, then property professionals need to find effective ways to incorporate sustainability issues into their processes of calculating worth (a methodology for linking sustainability issues to calculations of worth is described in Sayce et al., 2006).

The internationally accepted definition of market value can be found in International Valuation Standards and reads as follows: 'Market Value is the estimated amount for which a property should exchange on the date of valuation between a willing buyer and a willing seller in an arm's-length transaction after proper marketing wherein the parties had each acted knowledgeably, prudently and without compulsion' (IVSC, 2005, p. 82). The definition of market value is closely connected to the concept of highest and best use which is a 'fundamental and integral part of Market Value estimates' (IVSC, 2005, p. 29). Highest and best use is defined in international standards as follows: 'The most probable use of a property which is physically possible, appropriately justified, legally permissible, financially feasible, and which results in the highest value of the property being valued' (IVSC, 2005, p. 29). Since market valuation always means estimating the most likely price attainable within a hypothetical transaction, highest and best use analysis must always be the first step within the valuation process because this analysis forms the basis for identifying comparable properties and it identifies the most profitable or competitive use to which the property can be put. It is this use of a property which determines its utility for a potential purchaser. Highest and best use is shaped by the competitive forces within the market where the property is located. Analyzing these forces means setting 'the foundation for a thorough investigation of the competitive position of the property in the minds of the market participants' (AI, 2001, p. 306). Thus, the property valuer has to view the transaction through the eyes of a

Key Financial Indicators for sustainable buildings

hypothetical buyer; i.e. to replicate the hypothetical buyer's calculation of worth. Furthermore, the valuer must consider all possible buyers in the market in order to identify what is likely to be the highest and best bid. Without any question, this is a difficult task since the valuer has not only to identify the best bidder in the market but also the level of this bid.

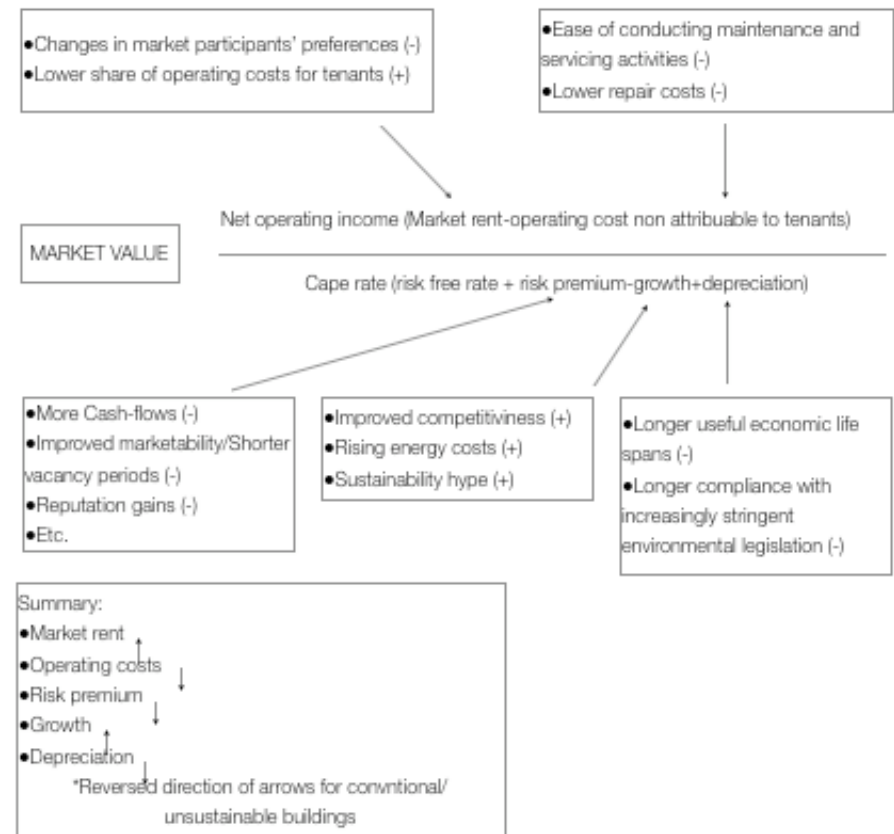
As it was said before, identifying what is likely to be the highest bid for the property under investigation involves studying market forces in order to determine the competitive position of the property in the marketplace. Thus, property valuation should always take into account any changes in the market participants' view of the benefits associated with the ownership of property assets. If valuers take this task seriously, the importance of accounting for sustainability issues cannot be overstated. Sustainability issues are among the most influential market forces currently observable and this is likely to have tremendous impact on the competitive position of properties in the marketplace. In valuation practice this means adjusting valuation input parameters.

This figure also shows that the mechanisms for linking sustainability issues to estimates of Market Value are known. However, this applies in theory only. What is missing is the operational underpinning and quantification of these relationships through real-world data. What is also missing is better and more profound understanding of the fundamental behavioural underpinnings that drive value. Current valuation practice – i.e. the isolated analysis of financial variables alone and their subsequent transformation into a one-sided understanding of the economic value of property – has led to an artificial separation of economic, environmental, social and cultural measures and components of property value. This understanding is fundamentally wrong and misleading since it fails recognizing that, in truth, the different components of property value are intrinsically linked and non-divisible.

Property, or the process of investment and management, has the capacity to create (or destroy) value consisting of different components. A fixation on economic value alone and an understanding of economic value as the end of all things does not make a great deal of sense.

The increasing recognition among the wider public but also within parts of the property and construction industry that the maintenance of life and well-being depends – to a significant degree – on the environmental and social performance of buildings and the built environment means that the current understanding of property value needs major revision.

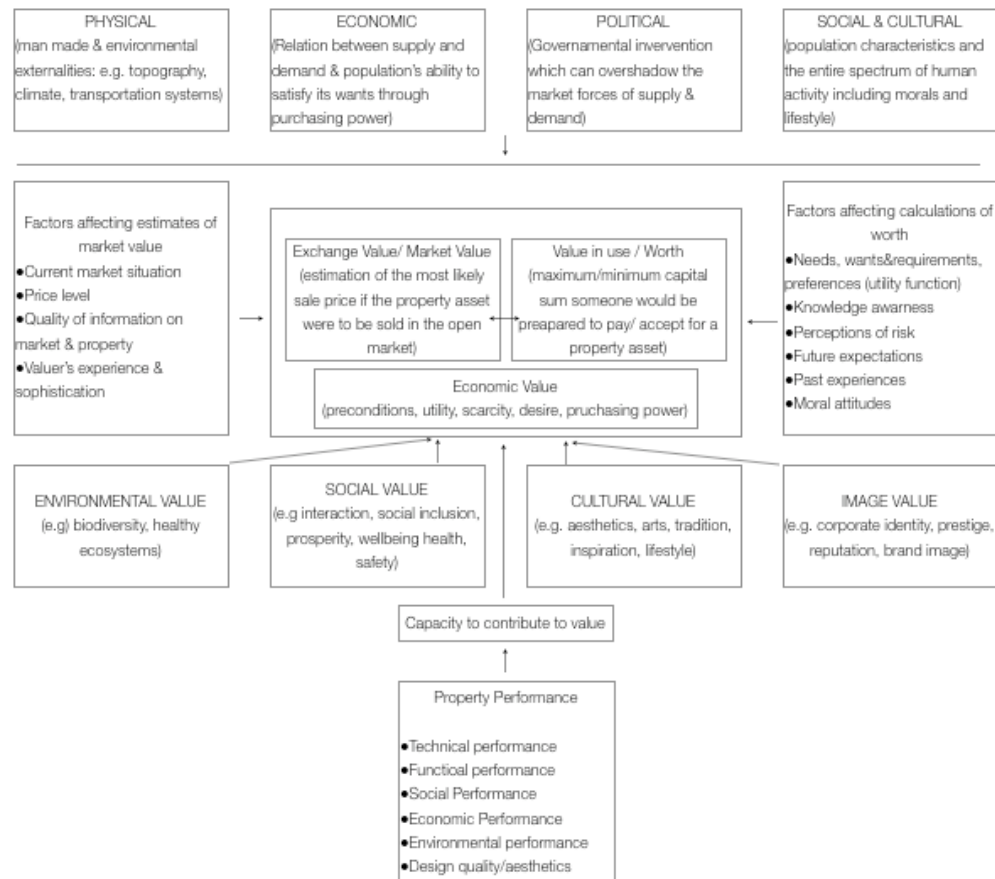
In fact, it is becoming evident that a property's economic value also depends on the building's capability to create and protect environmental, social and cultural values and that an isolated



analysis of mere financial variables is no longer (and has never been) adequate. It is also becoming evident that the use of financial performance indicators does not make sense if not underpinned and linked to non-financial performance indicators of buildings.

Key Financial Indicators for sustainable buildings

It has therefore been argued that advanced valuation methodology – like hedonic pricing techniques – can and must be applied in order to continuously monitor market behavior and shifts in value perceptions in order to provide a more scientific basis for the price or value adjustments that have to be made to account for the benefits of sustainable design features not solely reliant upon the knowledge, judgment and experience (or inexperience) of the individual valuer alone (Lorenz et al., 2007).



But the application of advanced valuation methodology can only provide meaningful results on the relationships between environmental, social and financial building performance if the quality of building descriptions contained in property transaction databases does allow drawing such conclusions.

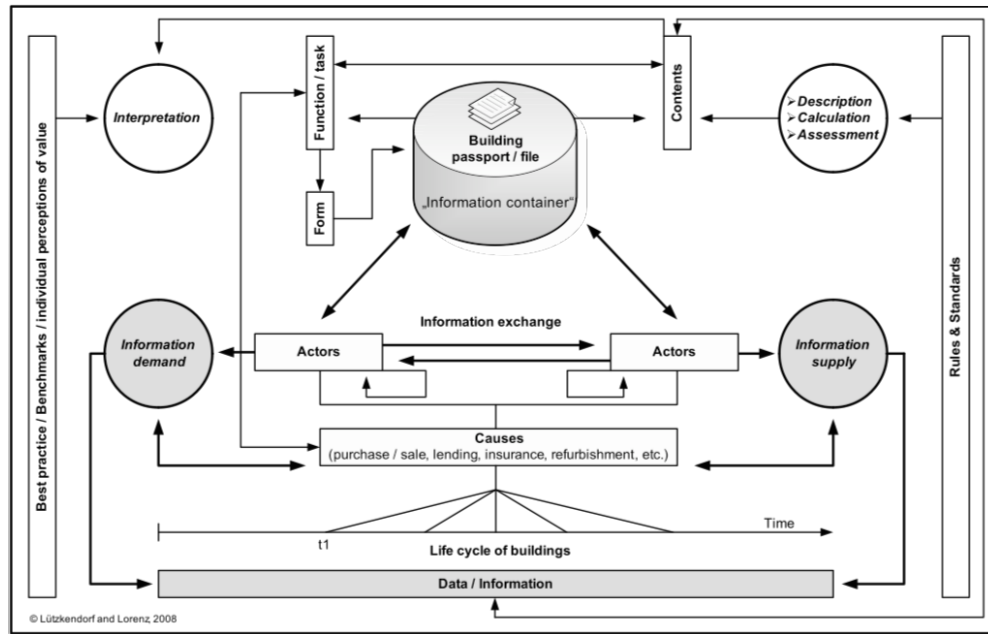
Unfortunately, at the moment this is not the case since we do not yet have performance-based building descriptions in property transactions databases. Performance-based building descriptions are arguably missing in almost all transaction databases. So valuers are left alone when forming an opinion of value for the foreseeable future as it will take years to accumulate the informational data basis necessary to empirically underpin a valuer's decision to provide a 'valuation bonus' for a sustainable building or a 'valuation reduction' for a conventional one.

But how to solve this dilemma? Apparently, the solution is in creating databases for property-related information management and decisions support that link environmental, social and financial performance of buildings. In this regard, the role of building files needs to be emphasized.

What is needed is a systematic description of major characteristics and attributes of buildings for various purposes such as valuation, risk assessment and certification; i.e. a reliable and cost-effective source of information for property professionals.

A building file can be described as an 'information container' which supports the exchange of information along the life-cycle of buildings between actors in property and construction markets.

Key Financial Indicators for sustainable buildings



Building files have been discussed in Europe since a considerable period of time. However, building files are yet only issued occasionally on a voluntary basis. In addition, building files are not yet standardized. The introduction and dissemination of building files in property markets is currently hampered by ambiguous and unclear perceptions regarding their informational content and function. Usually building files are either seen as a kind of building manual, as an extended construction and building specification, as a quality assurance system or even as a label or certificate. However, they are more of a medium for information exchange. There exists a clear need for provisioning, extending and updating building related physical and technical performance information along the life cycle of assets. This information has to be gathered and compiled on a scientifically robust basis during the planning phase as well as during the subsequent phases of operation and refurbishment.

Finally, if property professionals could draw upon building files to support their daily work, they would be in a better position to assess and report both value creation and risk reduction through sustainable design; and in doing so, incentivizing change and more sustainable behaviour.

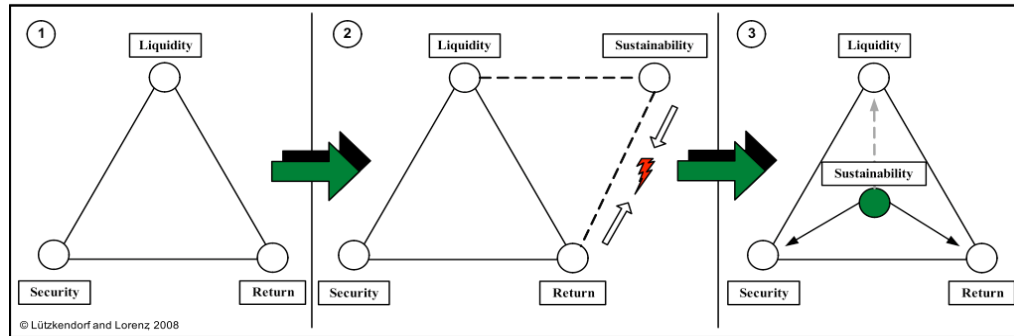
Conclusions and outlook

Within the property sector sustainability issues link through to financial performance in many ways. In some cases the relationship is straightforward, can be measured, benchmarked and improved. Also, in these cases the costs and benefits of taking action can be calculated (e.g. payback periods of energy efficiency improvements). In other cases, however, the relationships are less clear and much more difficult to capture (e.g. when dealing with assessments of risk and estimates of value). This is also due to the nature of real estate and scarcity of data. For example, in the wider corporate and financial sector where data on financial and non-financial performance measures is more readily available, there is now widespread recognition that economic success is intrinsically linked to environmental and social performance (see: UNEP FI, 2007). As consequence, shifts in prevailing investment paradigms have already taken place.

The linkage between economic success and environmental and social performance is clearly true for the property sector but here the strengths or magnitudes of relationships are more difficult to describe, quantify and communicate. In any case, the positive impact of sustainable design on financial performance tends to get stronger and is driven by:

- A growing number of SRI-oriented investors and managers;
- Changes in occupational demand and consumer behavior;
- Rising energy costs;
- Increasingly stringent environmental legislation; and
- A better understanding that many 'externalities' of modern society are explicitly linked to poor design; i.e. anti-social behavior, hostile public spaces, social conflicts, occupational diseases, contaminated land, contribution to climate change and thus environmental hazards, urban sprawl, and the urbanization of the countryside.

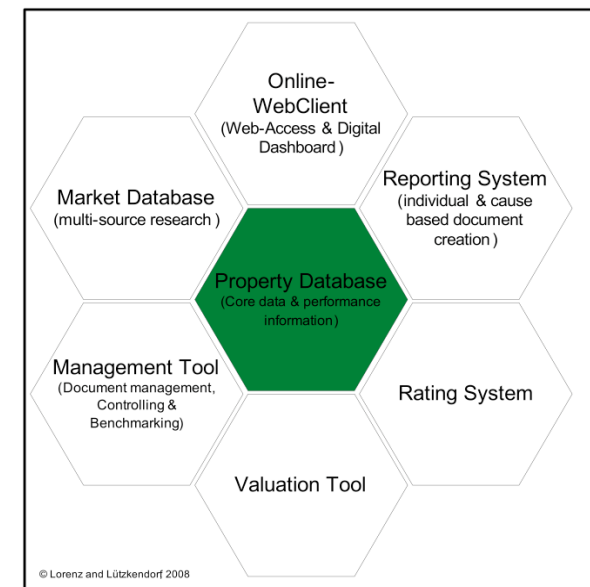
Key Financial Indicators for sustainable buildings



Linking financial performance with physical and technical building performance is a great challenge, without doubt. It would mean changing the feedback structure, the information links and data the actors in property markets work with. But it has been shown that at the backbone of understanding variations in financial performance metrics such as returns, risk and value lie, to a considerable extent, non-financial but physical and technical performance indicators. This renders observing the financial performance of buildings and property investments in isolation useless and misleading.

So what's next and how to apply all this in practice? Property professionals and decisions makers will need new decision support instruments for property-related information management and decisions support. This is because investors and their professional advisors are now forced to analyze and evaluate various aspects of building performance and the attractiveness of a particular location in great detail while they are simultaneously required to take into account a variety of complex institutional influences and externalities at global, regional and national level. The success of property investments and the competitiveness of investors and their professional advisors strongly depends upon knowledge and on the capabilities and sophistication to assess, interpret and understand the increasing complexity of factors from diverse sources of real estate information (see: Castells, 1996). This means that decision support instruments will have to allow for interlinking information from sources such as market and transaction databases, building files, sales portals, land registers, geographical information systems, national statistics bureaus, etc. in order to enable property professionals to fulfill their role as 'information managers' in a market where the distribution of information is traditionally considered asymmetrical. In addition to that, it

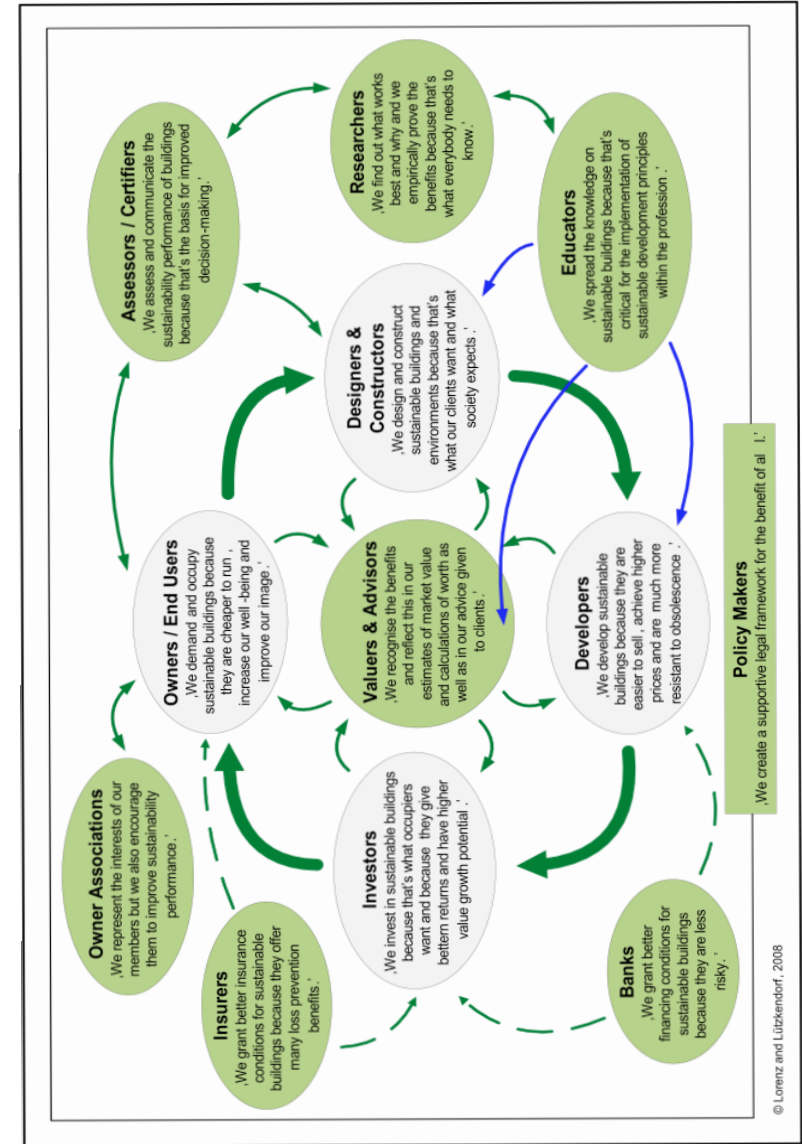
is necessary that depending on the situation information can be provided in different formats along the life-cycle of buildings; this includes, for example, the creation and updating of valuation and rating reports as well as performance certificates and benchmarks, etc. The basic idea of such a decision support instrument including a property database and related systems and tools is conceptualized in Figure below (Lorenz & Lützkendorf 2008).



Most importantly, however, new decision support instruments will have to bridge the gap between financial, environmental, social, physical and technical performance measures and thus, components of property value and help to establish the necessary feedback-mechanisms that incentivize and drive change in the property industry. This requires a synergy we have not seen so far; i.e. an integration of the traditional methods and tools for valuation, risk analysis and cost estimation with the methods and tools developed by the sustainable building community for assessing and communicating the contribution of buildings to sustainable development. The connection, though yet missing, between these two kinds of methods and tools is seen in the

Key Financial Indicators for sustainable buildings

introduction and widespread dissemination of building files within the property and construction industry. It is clear that the challenges and difficulties in creating next generating decision support instruments lie as much in the further development of IT-systems and tools as in the improvement of the informational data basis available in the property industry.



Conclusions

Sustainability metrics have the potential to turn the generic concept of sustainability into action. Today, however, we are far from achieving this potential.

Sustainability metrics have evolved by leaps and bounds over the past few decades. To keep it simple:

The earliest were merely absolute metrics of whatever was easiest to measure. Things that were difficult to measure were either ignored or given an arbitrary value.

The next development was the conversion of absolute measures into relative measures, such as ratios, which screen out statistical 'noise' such as differences in size or output, and focus on relationships.

The third generation compared less conventional risk measurements (e.g. environmental risk) with conventional economic risk. This was when the financial benefits of sustainability performance began to show.

Lately, practitioners have combined all of this approaches, together with newly minted Life Cycle Assessment data, leading to a much more accurate and comprehensive description of the impacts but with a tendency to information overload and poor international comparability. The challenge is now shifting from metric availability to metric suitability and international comparability.

The analysis of existing assessment systems in appendix demonstrates that most of the building environmental assessment methods currently in use in the marketplace where not designed to assess the full range of sustainability issues. They are predominantly focused on the assessment of environmental issues and often have a significant local flavor (national regulations, local building practices, climatic zones, etc.) and therefore corroborates this statement.

Today, we can't find a standardized set of indicators, and several private corporations are creating their own, suitable for their purposes, while international institutions are still trying to develop a generic indicator for measuring and monitoring sustainable development.

The quest for a standardized measure of performance which can be used to monitor and compare internationally ecological behaviour and performance in a clear and consensual manner, that allows practitioners to assess the build environment on a multi-scale & multi-criteria basis has not ended.

Environmental, health and safety (EHS) metric theory has undergone a major transformation over the past 30 years.

Driven by evolving EHS strategies and public attitudes, the shift is clearly moving away from the traditional, regulatory-based metrics toward broader measurements of corporate responsibility.

This evolution is well described in the work by the TNO Institute for Strategy, Technology and Policy in the Netherlands:



Aspect	First	Second	Third	Fourth
Drivers	Legislation and external pressure	Efficiency	Strategic performance	Societal license to operate
Public attitude	"Trust me"	"Tell me"	"Show me"	"Involve me"
Measures	Clean-up operations	Prevention	Chain management	Sustainable measures
Functions	Registration, monitoring	Process changes, communication	Product design, balanced scorecard	Integrated decision-making, portfolio assessment
Expression	Emissions, costs	Material and energy use, efficiency	Eco-efficiency, product characteristics	Ressources, societal costs/values
Scope	Substances, emissions	Processes	Products, production, chain processes	Sustainability issues
Reference value	Regulatory targets	Other processes previous years	Other products, suppliers	Societal values, sustainable issues

(L. Simons, A. Slob, and H. Holswilder, "The Fourth Generation - New strategies call for new indicators," TNO Institute of Strategy, Technology and Policy,Netherlands, September 2000).

In addition to the changing theory of EHS metrics, there has been a dramatic increase in the spectrum of assessment methods in many countries since the introduction of BREEAM in the 90's (Richard MacLean 2002).

With many countries either having, or being in the process of developing domestic assessment methods, international exchanges and coordination have being increasingly evident.

Conclusions

In 1997, for example, the International Organization for Standardization's Technical Committee 59 (ISO TC59) resolved to establish an ad hoc group to investigate the need for standardized tools within the field of sustainable building. This subsequently evolved and was formalized as Sub-Committee ISO TC59/SC17 – Sustainability in building construction – the scope of which includes the issues that should be taken into account within building environmental assessment methods.

In Europe, under CEN TC350 -Sustainability of Construction Works, a consensus-building process that relates to other standards (ISO) and harmonizes existing approaches was launched. These standards shall enable the exchange of sustainability information related to internationally traded products and services.

Other initiatives, mainly in the research field, such as the following EU funded research programs :

- CRISP
- LifeTime / LifeCycle initiative
- European thematic network on practical recommendations for sustainable construction

Have evidenced the need for international coordination and advanced the stabilization of language and the standardization of the description frameworks for environmental impacts.

An interesting example of such efforts is the The LEnSE project, a 6th Framework project co-funded by the EC, that was completed in March 2008.

The programme draws on the existing knowledge available in the European Union on building assessment methodologies and aimed a methodology development towards a label for environmental, social and economic buildings in analogy with the Energy Performance Directive.

The project developed a list of key issues that were considered relevant when assessing the sustainability of any building types. The LEnSE framework is intended to cover all aspects of sustainability rather than just focussing on the environmental aspects. This framework was used to compare the most well known systems (see appendix for more details).

So we have seen that sustainability is a matter of ever-increasing international concern among OECD countries. The many existing measures vary enormously both in their complexity and in their application. Those which gain attention over the broadest range are for the moment the so called

building environmental assessment methods that permit a ranking or profile of buildings in terms of ecological performance.

The difficulty then arises that such methods don't travel very well, and can seem counter-intuitive when compared with each other for the same building. This can for example be denoted in Europe's biggest business district, La Défense, where several high-rise buildings are currently being assessed with two or more methods at the same time, without any kind of coordination on the part of the scheme operators. This situation is profoundly unhelpful for those who wish to establish and refer to international standards.

There may always be differences between the relative standards set between each system, even if there is a clear move towards more international comparability, comparison with other standards markets, such as the LPCB and VdS standards relating to the approval of sprinkler systems and safe doors, suggests that once there is transparency the market will mature to allow 'licensing', 'cross certification' and 'multiple labelling' in a concerted way.

These developments and the work of leading international organizations will probably result in the near future in the development of a measure of ecological behaviour which can yield unequivocal metrics, and which would be credible in the company of nations. International organizations are raising awareness amongst owners and occupants of the practical choices open to them in the design, construction and operation of their buildings and sharing experiences in promoting this agenda. Working to create and strengthen links, metric and promotion of sustainability practices would have a dramatic effect both in terms of accessibility and in contributing to the development of government policy and industry strategies. The international dimension and coordination is paramount in taking this forward. Increased international benchmarking and mapping of standards are vital. Drivers and needs vary considerably between climates, regulatory frameworks and, indeed, social and cultural priorities, and so there is no scope for a «one size fits all» approach.

Appendix:

Appendix: Review of «Green building» rating tools

This review is not intended to conclude which scheme is most successful, either commercially or technically, (as numerous such studies have already been carried out) but to identify commonality between the systems in terms of the issues that they all cover and also those which they exclude. The ultimate aim is to identify a common core of issues that should be covered by any assessment system and consider how they may need to be tailored for use in other geographical locations, especially developing countries.

Schemes covered

The assessment systems covered by the review are as follows:

- BREEAM, the BRE Environmental Assessment Method owned and operated in the UK by BRE Global.
- CASBEE, the Comprehensive Assessment System for Building Environmental Efficiency owned and operated in Japan by the Japan Sustainable Building Consortium.
- GREEN STAR, owned and operated in Australia by the Australian Green Building Council.
- HQE, Haute Qualité Environnementale (High Environmental Quality). The method is owned by the Association HQE. Certification bodies are empowered by AFNOR to deliver the NF (building type) / démarche HQE mark.
- LEED, Leadership in Energy and Environmental Design owned and operated in the USA by the US Green Building Council.
- Protocollo ITACA, owned and operated in Italy by ITACA the Federal Association of the Italian Regions.

Brief descriptions of each of the systems covered, their technical content and scope are set out. Information is also provided regarding new developments for each scheme covering new version currently under development or in their pilot phase.

A summary of the basic information on each system, the building types covered and assessment life cycle stages covered are shown. Other assessment systems not covered in this detailed review are covered in following section of the report.

Note:

[i] The versions of BREEAM used for this analysis were BREEAM 2008 (design, fit out and post construction stages) and BREEAM 2006 (operational stage).

[ii] The versions of CASBEE used for this analysis were CASBEE NC (new construction) and CASBEE EB (Existing Buildings).

[iii] The version of Green Star used for this analysis was Green Star v3 (design and as built).

[iv] The versions of HQE used for this analysis were TBC.

[v] The versions of LEED used for this analysis were LEED for New Construction & Major Renovations (version 2.2);

LEED for Existing Buildings and LEED for Homes.

[vi] The versions of Protocollo ITACA used for this analysis were TBC.

BREEAM

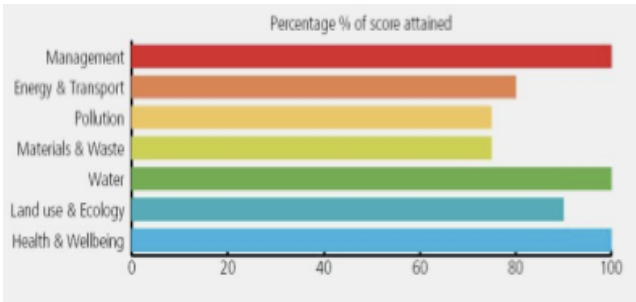
BRE's environmental assessment method

Introduction

BRE Global Limited (incorporating LPCB & BREEAM) and FBE Management Ltd are wholly owned subsidiary companies of the BRE Trust (formerly called the Foundation for the Built Environment) a charitable company whose objectives are through research and education, to advance knowledge, innovation and communication in all matters concerning the built environment for public benefit. BRE Global is an independent third party approvals body offering certification of fire, security and sustainability products and services to an international market.

BREEAM assessments are carried out by independent assessors who are licensed and trained by BRE. BRE is responsible for the technical content of the BREEAM schemes, training of assessors, quality assurance, certification of each assessment and finally updating the various BREEAM schemes at regular intervals. A "Sustainability Board" oversees BRE's guides, publications, standards and certification schemes in the area of "green buildings", energy, waste, sustainability and the environment.

Display of Results



Description of System

The BREEAM (Building research establishment's assessment method) assessment process was launched in the UK in 1990 with the first two versions covering offices and homes. Versions are updated regularly in line with UK Building Regulations and different building versions have been created since its launch to assess various building types. Each version of BREEAM considers a broad range of environmental impacts under the following issue categories:

BREEAM considers a broad range of environmental impacts under the following issue categories:

- ★ Management
- ★ Health and Well-being
- ★ Energy
- ★ Transport
- ★ Water
- ★ Materials & Waste
- ★ Land Use and Ecology
- ★ Pollution

Credits are awarded in each of the above areas according to performance. A set of environmental weightings is then applied to each category before the calculation of the final overall score. The building is then rated on a scale of PASS (minimum acceptable), GOOD, VERY GOOD or EXCELLENT (highest rating) and a certificate awarded to the development.



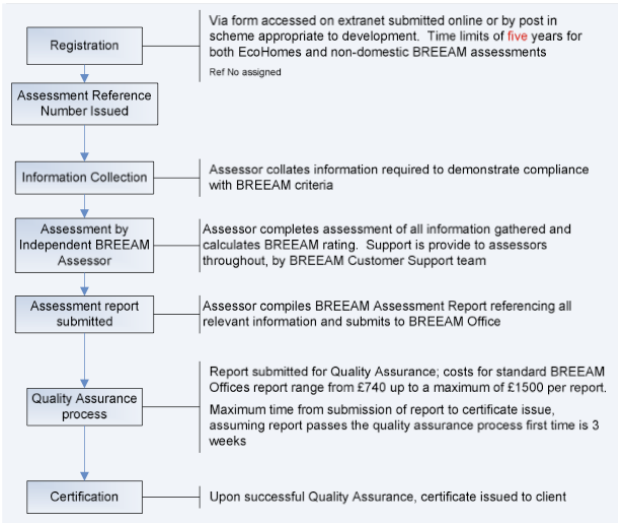
BREEAM Logotype

Current versions

- ★BREEAM: Courts all court buildings
 - ★BREEAM: EcoHomes new and refurbished housing
 - ★BREEAM: Education schools and further education colleges
 - ★BREEAM: Healthcare hospital and other healthcare buildings
 - ★BREEAM: Industrial light industrial and storage/distribution buildings
 - ★BREEAM: Multi-Residential multi-occupancy buildings student residences, care homes, key workers housing, etc.
 - ★BREEAM: Office: commercial office buildings
 - ★BREEAM: Prisons: prisons and other secure accommodation
 - ★BREEAM: Retail: all retail buildings
- In addition there is BREEAM: Bespoke which enables any building not covered by a standard version above to be assessed.*

Life cycle stages

- BREEAM assessments may be carried out at the following life cycle stages:
- ★Design & Procurement design and procurement of new construction and major refurbishment projects.
 - ★Fit Out internal fit-outs of new and existing buildings (Retail & Office schemes only)
 - ★Post Construction new construction and major refurbishment projects 'as constructed'.
 - ★Management & Operation management of existing buildings (Retail & Office schemes only)



Third Party verification Process

International use of system

Under development

BREEAM: Developments development / neighborhood scale impacts / issues. BREEAM: In Use, management of all existing building types (to replace Management & Operation version) BREEAM: Outstanding exemplar buildings which achieve performance levels beyond an EXCELLENT rating BREEAM: Sport & Leisure all sport and recreational facilities.

Versions of BREEAM suitable for use in Europe and the Gulf region are under development and will be launched for use in August 2008. One-off 'bespoke' BREEAM assessments have been, and are being, carried out in 16 countries. In all cases the BREEAM criteria have been adapted to suit the local context.

CASBEE

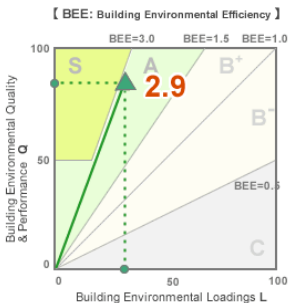
Coprehensive Assessment System for Building Environmental Efficiency

Introduction

In Japan, a joint industrial/government/academic project was initiated with the support of the Housing Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT), in April 2001, which led to the establishment of a new organization, the Japan GreenBuild Council (JaGBC) / Japan Sustainable Building Consortium (JSBC), with its secretariat administered by the Institute for Building Environment and Energy Conservation (IBEC). The Japan Sustainable Building Consortium (JSBC) and its affiliated sub-committees provide overall management and carry out the R&D of the Comprehensive Assessment System for Building Environmental Efficiency (CASBEE), the secretariat is set within the Institute for Building Environment and Energy Conservation (IBEC).

Display of Results

CASBEE RANK **A** ★★★★★★
TOOL: CASBEE for New Construction (2004 edition)



Description of System

Under CASBEE there are two spaces, internal (building and private property) and external (surrounding neighbourhood), divided by a hypothetical boundary (typically defined as the site boundary). Factors relate to each of these two spaces as follows: • Q (Quality): Building Environmental Quality & Performance Evaluates "improvement in living amenity for the building users, within the hypothetical enclosed space (the private property)." • L (Loadings): Building Environmental Loadings Evaluates "negative aspects of environmental impact which go beyond the hypothetical enclosed space to the outside (the public property)."

CASBEE assesses issues under the following categories:

- ★Energy efficiency
- ★Resource efficiency
- ★Local environment
- ★Indoor environment

Each issue within CASBEE is individually weighted after which further weighting factors are also applied to each section of the assessment. The total score is then calculated and the building rated on a scale of C (Poor), B-, B+, A or S (highest rating).

CASBEE Logotype



Current versions

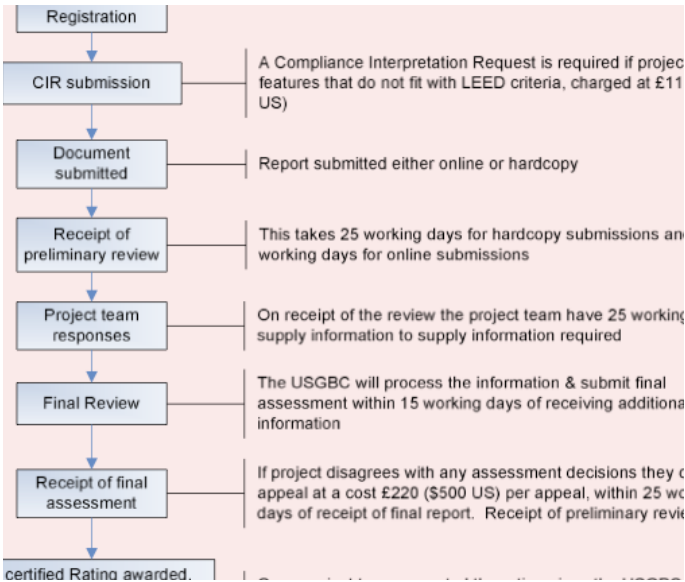
All CASBEE versions cover the following building types:

- ★Apartments
- ★Factories
- ★Halls
- ★Hospitals
- ★Hotels
- ★Offices
- ★Restaurants
- ★Retail
- ★Schools

Life cycle stages

CASBEE has a number of different versions dependent on the life cycle phase of the building:

- ★CASBEE for New Construction design and construction stages for new buildings
- ★CASBEE for Existing Building operational buildings
- ★CASBEE for Renovation design and construction stages for refurbished buildings
- ★CASBEE for Homes covering detached houses
- ★In addition there is a version of CASBEE (CASBEE UD) covering community / neighborhood scale impacts.



Third Party verification Process International use of system

Under development

The following CASBEE versions are under development:
CASBEE for PreDesign a tool to assist designers at the early stages.

CASBEE is active in China through the following projects: The design of the venues for the 2008 Beijing Olympics followed the framework of CASBEE. The Green Building Standard of the city of Beijing is based on CASBEE. Collaboration on performance evaluation of buildings with Tsinghua University. GOBAS, which has been developed by Tsinghua University for the assessment of their facilities. JSBC is supporting the development of a new assessment tool in South Korea and various CASBEE manuals are also being translated into English, Korean and French.

Description of System

Green Star was launched in 2003 and is owned and operated in by the Australian Green Building Council. Green Star has built on existing systems and tools in overseas markets including the BREEAM and LEED systems. In addition, VicUrban, in its work with the Melbourne Docklands' ESD Guide, provided the intellectual property to assist in the development of a local system.

GREEN STAR (Each version) considers a broad range of environmental impacts under the following issue categories:

- ★Management
- ★Indoor Environment Quality
- ★Energy
- ★Transport
- ★Water
- ★Materials
- ★Land Use & Ecology
- ★Emissions
- ★Innovation

Environmental weighting factors are applied to each category total before the final rating is calculated. These environmental weighting factors vary across states and territories to reflect the diverse range of environmental concerns across Australia. The final rating is issued as One Star (minimum acceptable), Two Stars, Three Stars, Four Stars, Five Stars or Six Stars (highest rating).

GREEN STAR Logotype



Current versions

Green Star currently covers office buildings only, but has a number of different versions to assess different life cycle stages.

Life cycle stages

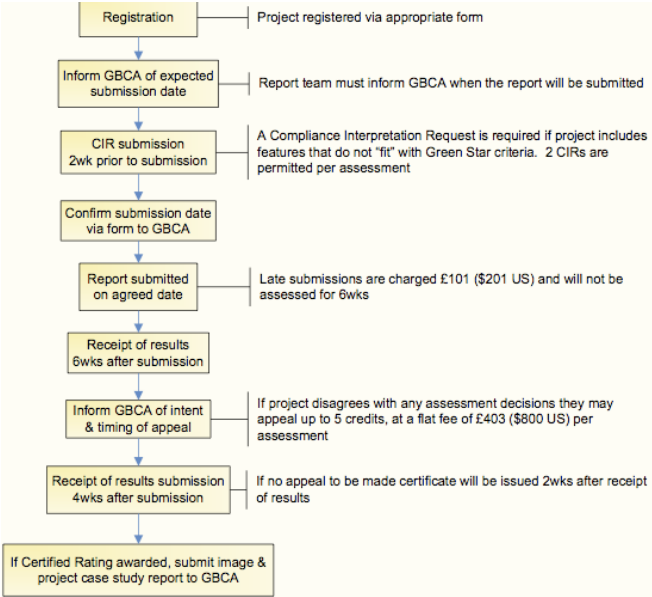
- ★Green Star Office Design design and procurement of new construction and major refurbishment projects
- ★Green Star Office As Built
- ★new construction and major refurbishment projects 'as constructed'
- ★Green Star Office Interior internal fit-outs of new and existing buildings

Introduction

The Green Building Council of Australia was created to promote sustainable development and the transition of the property industry by promoting green building programs, technologies, design practices and operations.

Green Star was developed to be a comprehensive, national, voluntary environmental rating scheme that evaluates the environmental design and achievements of buildings. In addition, VicUrban, in its work with the Melbourne Docklands' ESD Guide, provided the intellectual property to assist in the development of a local system.

Display of Results
(Not found)



Third Party verification Process

International use of system

Under development

The following versions of Green Star are currently under development:

- ★Green Star Office Existing Building
- ★Green Star Education
- ★Green Star Retail Centre
- ★Green Star Multi-Unit Residential
- ★Green Star Healthcare
- ★Green Star Industrial
- Green Star Mixed Use

A version of Green Star has been adapted for use in New Zealand and is now the adopted building assessment system of the New Zealand Green Building Council.

Introduction

Assessment is voluntary, but certification will require verification by an independent body. The HQE generic method is defended by the Association HQE France’s Green Building Council de facto. The certification mark is owned by AFNOR (France’s national standards-setting organization and ISO representative). Two Certification bodies Certivéa, Cerqual and Cequami are mandated by AFNOR to deliver the NF Bâtiments tertiaires/démarche HQE mark for tertiary buildings, the NF Logement/démarche HQE for residential, and the NF Maison Individuelle/démarche HQE for homes. Certivéa is a subsidiary of France’s national Building Research Center: CSTB. Cerqual is a subsidiary of the QUALITEL Association an independent body specialising in the property sector, Cequami is a joint venture that brings together CSTB and Qualitel.

Display of Results

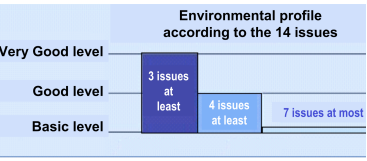


Description of System

HQE is a national certification system for residential and non-residential buildings. The system identifies 14 environmental issues and covers two aspects: environmental quality of the building, and environmental management of the entire project. The two aspects have been translated into linked reference frameworks, with performance criteria in the first and management requirements in the second. This “two-in-one” concept is probably HQE’s most original aspect. 14 environmental issues have been defined, they fall into four main areas, the first two having to do with the exterior environment and the second two with the interior.

Exterior Environment	Interior Environment
SITE and ECO-CONSTRUCTION ISSUE 01 : Relation between the building and its immediate surroundings ISSUE 02 : Integrated choice of construction products, systems and processes ISSUE 03 : Low-impact construction site	COMFORT ISSUE 08 : Hygrothermal comfort ISSUE 09 : Noise and acoustics ISSUE 10 : Lighting ISSUE 11 : Odours
ECO- MANAGEMENT ISSUE 04 : Energy management ISSUE 05 : Water management ISSUE 06 : Activity waste management ISSUE 07 : Maintenance – Environmental performance conservation	HEALTH ISSUE 12 : Health conditions of spaces ISSUE 13 : Indoor air quality ISSUE 14 : Sanitary quality of water

Three levels of performance are set: “basic,” corresponding to current regulations or normal practice; “good”; and “very good”. Certification will be granted upon achievement of a “minimum environmental profile” comprising a “very good” rating for at least three issues, “good” for at least four and “basic” for no more than seven. For the “good” and “very good” rankings, a “principle of equivalence” is allowed. That is, the applicant can suggest an alternative assessment approach



to that described in the HQE reference framework in the case of any of the 14 issues.



HQE Logotype

Current versions

Current versions of HQE exist for the following building types:

- ★ Commercial centres
- ★ Hotels
- ★ Schools
- ★ Houses (NF Maison Individuelle HQE environmental option)
- ★ Residential (NF Logement HQE Environmental Option)
- ★ Offices
- ★ In Use

Life cycle stages

The assessments currently only cover new and refurbished buildings and certification audits must be carried out at the following stages:

- ★ End of brief
- ★ End of design
- ★ End of construction

Action/step	Actor involved and comments
Project pre-design phase	Building owner and design team: first audit by independent approved professionals.
Design	Design team, second audit by independent approved professionals.
Building delivery	Third audit by independent approved professionals.

HQE is a method own by the Association HQE not a certification mark. The “NF (type of building) /HQE approach” is a certification mark, own by AFNOR, the French national organization for standardization and is the country’s ISO member body. Independent third party certification bodies are mandated by AFNOR to deliver the mark, their role is to attest that the building complies with HQE criteria.

Third Party verification Process

International use of system

Under development

The following versions of HQE are currently under development:

- ★ Healthcare
- ★ Sports buildings
- ★ Operational buildings

HQE assessments are being carried out in 6 countries. A version of HQE has been adapted for use in Brazil. It was launched in April 2008 and criteria have been adapted to suit the local Brazilian context.

LEED

Leadership in Energy and Environmental Design

Introduction

The U.S. Green Building Council (USGBC) is a non-profit trade organization that promotes sustainability in how buildings are designed, built and operated. The USGBC established benchmarks for the LEED Green Building Rating System in 2000. LEED is a framework for assessing building performance and meeting sustainability goals.

LEED is voluntary and with no third party assessment. LEED is required or under consideration as a requirement for certain buildings in many U.S. localities.

Display of Results

Green Facts	
Nusta Spa Washington, DC	
LEED-CI rating out of 57	
Gold	34
Sustainable Sites	5/7
Water Efficiency	0/2
Energy & Atmosphere	9/14
Materials & Resources	8/14
Indoor Environmental Quality	7/17
Innovation & Design	5/5
USGBC LEED-CI rated March 14, 2005	



Description of System

LEED (Leadership in energy and environmental design) was launched in 2000 and is owned and operated in by the US Green Building Council.

LEED (Each version of) considers a broad range of environmental impacts under the following issue categories:

- ★ Sustainable Sites
- ★ Water Efficiency
- ★ Energy & Atmosphere
- ★ Materials & Resources
- ★ Indoor Environmental Quality
- ★ Innovation

Points are awarded in each of the above areas according to performance and the final overall score is calculated. The building is then rated on a scale of Certified (minimum acceptable), Silver, Gold or Platinum (highest rating) and a certificate awarded to the development.



BREEAM Logotype

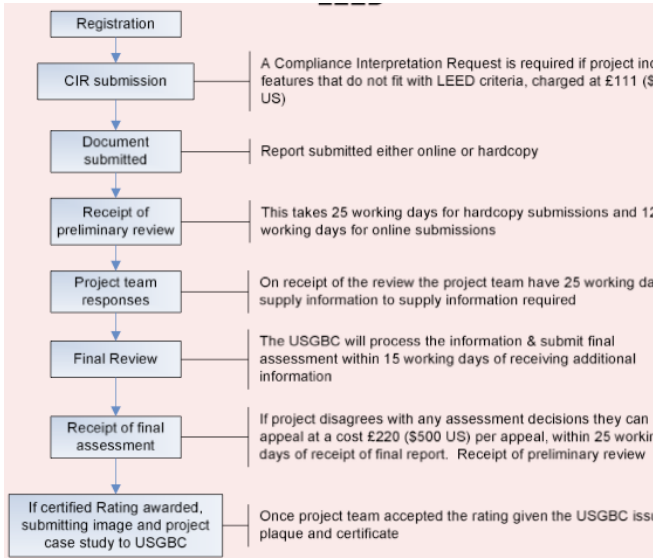
Current versions

The following LEED versions currently exist:
LEED for New Construction covering newly constructed and refurbished commercial and institutional projects
LEED for Existing Buildings covering existing operational buildings
LEED for Commercial Interiors covering fit-outs of new and existing commercial buildings
LEED for Core and Shell covering new shell and core projects
LEED for Schools covering schools and higher education projects
LEED for Homes covering all homes and residential buildings

Life cycle stages

LEED assessments may be carried out at the following life cycle stages:

- ★ Design & Construction
- ★ Operational



Third Party verification Process

International use of system

Under development

The following versions of LEED are currently under development:
LEED for Retail covering the refurbishment, construction and fit-out of all retail buildings
LEED for Healthcare covering hospitals and other healthcare projects
LEED for Neighborhoods covering development / neighborhood scale impacts / issues.

Versions of LEED have been adapted for use in Canada and India and are the adopted building assessment systems of their respective Green Building Councils. One-off assessments (using unmodified US LEED criteria) have been, or are being, carried out in 41 countries.

Protocollo Itaca

Istituto per l'Innovazione e Trasparenza degli Appalti e la compatibilit  ambientale

Introduction

ITACA, was created in 1996 by a consortium of Italian regions/ provinces, with the objective to promote and ensure effective coordination between the regions/provinces.

The objectives of the institute are :

- ★Development and promotion of transparency in the various phases of procurement and public concessions, including through the implementation of information systems for collecting and disseminating real-time information;
- ★the definition and development of procedures qualified for the management of procurement through the introduction of quality systems in administrative procedures inspired by the principles of UNI /EN / ISO;
- ★the promotion and dissemination of good practice in services, supplies and public works for the urban environmental sustainability.

The activity is carried out through committees and working groups composed by regional engineers, representatives from the state and local governments and organizations representing specific categories of the italian industry. iiSBEE Italia provides tcehncial support for the development of the Protocollo ITACA.

Display of Results (Not found)

Description of System

Protocollo ITACA (Istituto per l'Innovazionz e Trasparenza degli Appalti e la Compatibilit  Ambientale) was launched in Italy in 2004 and is owned and operated by ITACA, the Federal Association of the Italian Regions. The system was developed by the ITACA working group which was composed of representatives from the Italian Regions and iiSBE Italia. The system is based on iiSBE's SBTool framework but has been adapted to be suitable for use in Italy.

ITACA (full version) is split into the following categories and sub categories:

- Site Quality
 - ★Contamination status of land
 - ★Services
- Energy and Resource Consumption
 - ★Total life cycle primary energy
 - ★Renewable energy
 - ★Eco-friendly construction materials
 - ★Potable water
- Environmental Loadings
 - ★Greenhouse gas emissions
 - ★Rainwater, storm water and waste water
- Indoor Environmental Quality
 - ★Ventilation
 - ★Thermal comfort
 - ★Visual comfort
 - ★Acoustic comfort
 - ★Electromagnetic pollution
- Service Quality
 - ★Controllability of technical systems
 - ★Maintenance of operating performance
 - ★Common areas
 - ★Home automation (domestic schemes only)



BREEAM Logotype

Current versions

Versions of Protocollo ITACA currently exists for Residential buildings. Protocollo ITACA assessments may be carried out at the following life cycle stages:

- ★Design
- ★As Built.

Rating:

The building is then rated on a scale of -1, 0 (minimum acceptable), +1, +2, +3, +4, +5 (highest rating).

Life cycle stages

- BREEAM assessments may be carried out at the following life cycle stages:
- ★Design & Procurement design and procurement of new construction and major refurbishment projects.
 - ★Fit Out internal fit-outs of new and existing buildings (Retail & Office schemes only)
 - ★Post Construction new construction and major refurbishment projects 'as constructed'.
 - ★Management & Operation management of existing buildings (Retail & Office schemes only)

The method is developed by iiSBE Italia, the ITC-CNR, a national certification body is empowered to assess and deliver the certification.

Third Party verification Process

International use of system

Under development

Offices, Retail buildings, Schools and Tall buildings
Protocollo ITACA is a tool the tool promoted by the Sustainable Building Council Italia for residential buildings, a new tool is being developed by a consortium (iiSBE Italia and ITC) for offices, retail buildings, schools and high-rise buildings.

Protocollo ITACA is itself an adaptation of SBTool and so has not been adapted for use outside Italy. The core SBTool system can be calibrated to suit various different locations and localized versions have been developed for about 20 countries for use in the Sustainable Building Challenge Process. It has also been adapted to bespoke projects in Monaco and UAE..

Basic features, mode of implementation and coverage of each system

The following table outlines the basic information on each scheme along with its method of assessment, mode of implementation and number of buildings assessed. Information concerning

	BREEAM	CASBEE	GREEN STAR	HQE	LEED	ITACA
Year Launched	1990	2003	2003	2005*	1998	1996
Country of origin	UK	Japan	Australia	France	US	Italy
Information gathering	Design / managment team and/or assessor	Design / management team and/or accredited professional	Design team	Design team	Design / management team and/or accredited professional	Design / management team and/or assessor
Assessment	Licensed assessors	Accredited professionals	Accredited professionals	Approuved professionals	USGBC	Assessors licenced by local organizations
Third party verification	BRE Global	Third party agencies such as JSBC	GBCA	Approved Assessors, in situ inspectors and diagnostic professionals.	N/A	N/A
Certifying body	BRE Global	JSBC	GBCA	CERTIVEA for tertiary buildings. QUALITEL for residential	USGBC	ITC-CNR
Mode of implementation	Voluntary	Voluntary	Voluntary	Voluntary	Voluntary	Voluntary/R&D
Self assessment permitted	No	Yes	No	No	No	Yes
Rating Scale	Rating scale Pass, Good, very good, Excellent	C, B-, B+, A, S	One star, two star, three star, four star, five star, six star	Rating scale under the form of an environmental profile according to 14 targets.	Certified, Silver, Gold, Platinum	-1, 0, +1, +2, +3, +4, +5
Number of buildings certified	116	2011	58	NF HQE Residential : 290 logements. NF HQE (tertiary sector): 257 bâtiments. NF HQE Homes : 500	1823	Not Known
Number of Buildings registered for assessment	714	Not Known	Not Known	NF HQE Residential: N/A NF HQE Non residential (tertiary sector): 600 NF HQE Homes :438	Not Known	Not Known

Notes:
 * 2005 for NF HQE non residential, operated by Certivéa.
 * 1997 for the HQE generic methodology.

In France, QUALITEL launched in 2003 the «Habitat & Environnement» environmental certification for the residential sector. H&E represents 665 certified units (22 639 certified dwellings) & 3433 registered.

Life cycle phases covered by each system
 The assessment systems reviewed currently cover the following life cycle phases:

	Design	Fit out	As built	Operational
BREEAM	✓	✓	✓	✓
CASBEE	✓	✓	✓	✓
GREEN STAR	✓	✓	✓	✓
HQE	✓		✓	✓
LEED		✓	✓	✓
ITACA	✓		✓	

Comparison

Categorization of issues addressed by building assessment systems

- ★Building rating systems and existing labels: GB Tool, BREEAM, LEED, GPR GEBOUW, ECO-BAU, ESCALE, ...
- ★Cost calculation tools: LCC calculation, elements method, ...
- ★Calculation of energy performance:EN13790, national tools used in building regulation, thermal simulation tools, ...
- ★Infrastructure tools
- ★Sustainability incentives: tax credits, subsidies, green certificates, energy certificates, ...
- ★Existing review reports(e.g. International Energy Agency)
- ★Previous European projects: PRESKO, CRISP, BEQUEST, ECO-HOUSING, ...
- ★Existing standards and draft standards: ISO, CEN, AFNOR, ...

The LEnSE Structure.

When selecting the framework for carrying out the review of the systems presented above it was felt important to choose a neutral basis on which to compare them. For this reason the structure of the European Commission (EC) project LEnSE (Methodology Development towards a Label for Environmental, Social and Economic Buildings) was chosen. The LEnSE project, a 6th Framework project co-funded by the EC, was completed in March 2008. The project developed a list of key issues that were considered relevant when assessing the sustainability of any building types. One of the reasons for choosing the LEnSE framework was that it intended to cover all aspects of sustainability rather than just focusing on the environmental aspects. In this respect it was considered that it should address most of the issues covered in each system and, in addition, would demonstrate the degree to which existing assessment systems address the full range of sustainability aspects of buildings.

The main objective of this LEnSE project was to review existing assessment methodologies – such as environmental assessment tools, cost calculation tools, calculation of energy performance, building rating systems, incentives, environmental risks etc. – in order to extract the sustainability issues in these methods. At the same time, information was collected on the success factors of these existing assessment methods in Europe. The result of this reviewing exercise was a long list of possible issues to be included in the LEnSE sustainability assessment methodology. This list needed further refinement to become a sufficiently wide, but practically feasible set of sustainability issues.

The partners involved in this work have used a large number of documents, and particularly:

- ★Environmental assessment tools: LCA tools (e.g. LEGEP, ECO-QUANTUM, EQUER, ENVEST),
- ★studies regarding external cost, ...

Selected framework

The list of issues covered by LEnSE is illustrated in below. It should be noted that those issues shown in *italics* are additional issues that have been inserted for the purpose of this exercise.

THEME	CATEGORY	ISSUE	SUB-ISSUE
Environment	Climate change	Greenhouse gas emissions	Use of non renewable primary energy - Building
			<i>Monitoring of energy - Building</i>
			Use of non renewable primary energy - Transport
			Use of renewable primary energy
		Acidification and ozone destruction	Destruction of the stratospheric ozone layer
		Acidification and ozone destruction	Local tropospheric ozone formation
	Biodiversity	Eutrophication	Minimise point sources of eutrophication
		Mitigate impact on site ecology	Land of low ecological value
			Mitigating impact on existing site ecology
		Enhance site ecology	Enhance native plant / animal species
	Resource use	Materials consumption	Habitat management / action plan
			Depletion and use of renewable and non renewable resources (other than primary energy)
			Responsible sourcing of major building elements / operational materials
			Waste prevention
		Water consumption	Non hazardous waste disposal
			Hazardous waste to disposal
	Environmental management and geophysical risk	Land consumption	Use of freshwater resources
			<i>Monitoring of water use</i>
			Re-use of previously developed sites
			Development footprint
		Environmental management	Contaminated land, bioremediation and soil reuse
			Environmental policy / certified Environmental Management System
Social	Occupant wellbeing	Climatological and geological risk	Minimising regional specific climatological risk eg flooding
			Minimising regional specific geophysical risk eg seismic
			Building user comfort
			Lighting & visual comfort
		Spatial access	Thermal comfort
			Ventilation conditions
	Health & Safety	Acoustic comfort	Acoustic comfort
			Occupant satisfaction
		Materials / substance exclusion	Private space
			Outdoor space

		Land consumption	Re-use of previously developed sites
			Development footprint
		Environmental management and geophysical risk	Contaminated land, bioremediation and soil reuse
			Environmental policy / certified Environmental Management System
	Social	Climatological and geological risk	Minimising regional specific climatological risk eg flooding
			Minimising regional specific geophysical risk eg seismic
		Building user comfort	Lighting & visual comfort
			Thermal comfort
		Spatial access	Ventilation conditions
			Acoustic comfort
	Occupant wellbeing	Building user comfort	Occupant satisfaction
			Private space
			Outdoor space
		Health & Safety	Materials / substance exclusion
			Indoor air quality
		Key amenities - provision and proximity	Quality of drinking water
			Building safety
	Accessibility	Accessible public services and amenities	Public transport - frequency and proximity
			Provision of safe and adequate pedestrian route ways
		Accessible public transport	Provision of safe and adequate cycle lanes and cyclist facilities
			Facilitate / encourage use of alternative means of transport
	Communication	Building management	Building user education
			Information dissemination
		Building design	Site security and spatial arrangement
			Building security
	Security	Designing out crime	Community impact consultation
			Social cost benefit analysis
		Social and ethical responsibility	Socially responsible and ethical procurement of goods/services
			Considerate Constructors
	Social and cultural value	Sensitivity to the local community	External 'neighbourhood' impacts
			Design quality
	Economic	Financing and management	Function analysis
			Risk & value management
		Whole life value	WLC appraisal - Strategic level
			WLC appraisal - Component level
	Externalities	Whole life costs	Option appraisal
			Exchange value
		Asset value	Added value
			Building adaptability
		Maintenance	Design for maintainable buildings / ease of maintenance
			Local employment opportunities / use of local services
	Local and regional impacts	Specification / use of locally produced materials	Branding and external expression
		Image value	
	Image value	Branding and external expression	

Comparison

Types of benchmarks/ common set of issues

Types of benchmarks used within assessment systems

As well as identifying the issues addressed within building assessment systems, critical to any system’s success is finding a suitable means of benchmarking a building’s performance against them. When reviewing the technical content of each system the means of benchmarking each issue was also identified. Typically it was found that the means of benchmarking could be categorized in one of six ways as defined below:

Benchmark	Definiton
Agains national regulation	Performance measured as an improvement over national building regulations
Against national codes/ standards	Performance measured against national codes as BS, ANSI, NF
Against national best practice	Performance measured agains national industry best practice such as CIBSE, ASHRAE, etc.
Against international codes/ standards	Performance measured against international codes such as CEN, ISO, etc.
Against international best practice	Performance measured against industry best practice from another country.
Bespoke to rating system	Performance measured against a benchmark unique to assessment system (or a combination of the above benchmarks).

Benchmark	% Indicators
Agains national regulation	11.8
Against national codes/ standards	4.7
Against national best practice	34.2
Against international codes/ standards	2.9
Against international best practice	2.9
Bespoke to rating system	43.5

Use of national benchmarks
It is unsurprising that the use of national benchmarks far outweigh the use of international benchmarks, in fact two of the systems, CASBEE and HQE, use no international benchmarks at all. This reflects the need for such systems to be tailored to their local context in order to be accepted by their respective national construction industries

Common set of issues, Core concerns

One of the key aims of any comparison work should be to be able to identify not only the differences but also the common ground and the shared concerns.

This table defines those issues covered by five or more of the systems with those issues covered in all six systems highlighted in bold.

What is instantly apparent from this analysis is that the majority of the sub-issues covered by all of the systems are either classified as environmental (i.e. those relating to greenhouse gas emissions, water consumption etc) or could be considered quasi-environmental (i.e. those relating to building user comfort, accessible public transport etc) in that they have a combined social and environmental impact.

These findings should be confronted with the efforts currently undertaken to standardize the description and assessment of the environmental performance of buildings: in Europe under CEN/TC350, and at the international level under ISO TC 59 SC 17.

It is also interesting to replace these results within the context of the global economy to appreciate the importance of each category in the global GHG emissions production.

Action/step	Actor involved and comment
Greenhouse gas emissions	Use of non renewable primary energy - Building
	Monitoring of energy – Building
	Use of renewable primary energy
Acidification and ozone destruction	Destruction of the stratospheric ozone layer
Mitigate impact on site ecology	Mitigating impact on existing site ecology
Enhance site ecology	Enhance native plant/animal species
Materials consumption	Depletion and use of renewable and non renewable resources (other than primary energy)
	Responsible sourcing of majc building elements / operation materials
Water consumption	Use of freshwater resources
Land consumption	Re-use of previously developed sites
Climatological and geological risk	Minimizing regional specific climatological risk e.g. flooding
Building user comfort	Lighting & visual comfort
	Thermal comfort
	Ventilation conditions
	Acoustic comfort
	Occupant satisfaction

Full analysis of issues covered by each system

The following tables outlines ...

Theme	Category	Issue	Sub-issue	BREEAM	CASBEE	GREEN STAR	HQE	LEED	P.ITACA
ENVIRONME NT			Responsible sourcing of major building elements / operational materials	✓	✓	✓	✓	✓	
			Waste prevention	✓		✓	✓	✓	
			Hazardous waste to disposal				✓		
		Water consumption	Use of freshwater resources	✓	✓	✓	✓	✓	✓
			Monitoring of water use	✓		✓	✓		
		Land Consumption	Re-use of previously developed sites	✓		✓	✓	✓	✓
			Development footprint	✓			✓	✓	
			Contaminated land, bioremediation and soil reuse	✓		✓	✓		
	Environmental management and geophysical risk	Environmental management	Environmental policies /certified Environmental Management System	✓	✓	✓	✓		
		Climatological and geological risk	Minimizing regional specific climatological risk e.g. flooding	✓	✓	✓	✓	✓	
			Minimizing regional specific geophysical risk e.g. seismic		✓		✓		
SOCIAL	Occupant well-being	Building user comfort	Lighting & visual comfort	✓	✓	✓	✓	✓	✓
			Thermal comfort	✓	✓	✓	✓	✓	✓
			Ventilation conditions	✓	✓	✓	✓	✓	✓
			Acoustic comfort	✓	✓	✓	✓		✓
			Occupant satisfaction	✓	✓	✓	✓	✓	✓
		Spatial access	Private space				✓		
			Outdoor space	✓			✓	✓	✓
	Health & Safety		Materials/substance exclusion	✓	✓	✓	✓		
			Indoor air quality	✓	✓	✓	✓	✓	
			Quality of drinking water				✓		
			Building safety		✓				
	Accessibility	Accessible public services and amenities	Key amenities -provision and proximity	✓	✓		✓	✓	
			Public transport -frequency and proximity	✓		✓	✓	✓	✓

Theme	Category	Issue	Sub-issue	BREEAM	CASBEE	GREEN STAR	HQE	LEED	P.ITACA
SOCIAL	Accessibility	Accessible pedestrian networks	Provision of safe and adequate pedestrian route ways	✓			✓		
		Accessible bicycling network	Provision of safe and adequate cycle lanes and cyclist facilities	✓		✓	✓	✓	
		Alternative transport modes	Facilitate / encourage use of alternative means of transport	✓			✓	✓	✓
	Communication	Building management	Building user education	✓		✓	✓	✓	
		Building design	Information dissemination	✓			✓		
	Security	Designing out crime	Site security and spatial arrangement	✓			✓		
			Building security	✓			✓		✓
	Social & cultural value	Social & ethical responsibility	Community impact consultation		✓		✓		
			Social cost benefit analysis						
			Socially responsible and ethical procurement of goods/services		✓				
		Sensitivity to the local community	Considerate Constructors	✓	✓		✓	✓	
			External 'neighborhood' impacts	✓	✓	✓	✓	✓	
		Building aesthetics and context	Design quality		✓		✓		
ECONOMIC	Financing and management	Value management	Function analysis		✓				
			Risk & value management						
	Whole life value	Whole life cost	WLC appraisal - Strategic level	✓			✓		
			WLC appraisal component level	✓			✓		
			Option appraisal	✓					
		Asset value	Exchange value						
			Added value						
			Building adaptability				✓		
		Maintenance	Design for maintainable buildings / Ease of maintenance		✓		✓		
	Externalities	Local and regional impacts	Local employment opportunities/use of local services		✓				
			Specification/use of locally produced materials		✓		✓		
		Image value	Branding and external expression						

Overview of other building assessment systems

(Not covered by comparison analysis)



CONAVI –

MEXICO

The National Housing Agency of Mexico, CONAVI, has established a sustainable development model for Mexico. It is being demonstrated by Urbi, a leading housing developer in the development of Valle Las Palmas. Its particular strength is its concentration on the social and economic development of lower income families. It uses this basis as a means to protect the environment through efficiency. The project is intended to create an independent, ordered and sustainable town for some 1 million inhabitants, including energy independence, industry and services. The sustainable town is expected to continue developing until the year 2030. For further information contact CONAVI at www.conavi.org.mx.



Ecoprofile

Norway

Ecoprofile was developed by the Norwegian Building Research Institute on behalf of the Norwegian Environmental Protection

Department. The system is based on two earlier methods: 'Ecoprofile for Buildings' and 'Environmental and Resource Effective Commercial Buildings (ERCB)'.

The intention is that the system may be used on a number of different levels;

- As a design tool
- To classify a building's environmental performance
- As an environmental management tool

The Ecoprofile of a building is divided into three principal components, as follows:

- External environment

- Resources
- Indoor climate

Each of these components is divided into sub-components many of which also have underlying sub-areas which contain a number of different parameters (of which there are 82 in total). The sub-components are weighted to take into account the different impact that each of them has.



EEWH

TAIWAN

EEWH (Ecology, Energy saving, Waste reduction and Health) is the green building evaluation system adopted by the Taiwan Green Building Council.

The system is broken down into the following indices against which the performance of the building is assessed:

- Biodiversity
- Greenery
- Soil water content
- Daily energy saving
- CO2 emission reduction
- Waste reduction
- Indoor environment
- Water resource
- Sewage and garbage improvement

Building ratings are awarded by the Ministry of the Interior and there are currently five levels of performance: Certified, Bronze, Silver, Gold, Platinum and Diamond.



GREEN GLOBES

CANADA/USA



The genesis of the Green Globes system was BREEAM Canada for Existing Buildings which was based on the UK

BREEAM system and published in 1996 by the

Canadian Standards Association. In 2000, the system evolved into an online assessment and rating tool under the name Green Globes for Existing Buildings. Later that year, the Canadian Department of National Defense and Public Works and Government Services undertook to develop the system for the Design of New Buildings. The Green Globes system is used in Canada and the USA. In the USA, Green Globes is owned and operated by the Green Building Initiative (GBI). In Canada, the version for existing buildings is owned and operated by BOMA Canada under the brand name 'Go Green' (Visez Vert).

The system is broken down into the following technical sections:

- Management
- Site
- Energy
- Water
- Resources
- Emissions
- Indoor environment

The system is operated as an online tool which may be used as a design or management tool, self assessment or third party verified as a certified assessment (although this is not compulsory).



GREEN MARK

SINGAPORE

The BCA Green Mark Scheme was launched in January 2005 as an initiative to move Singapore's construction industry towards more environment-friendly buildings. It is owned and operated by the Singapore Building and Construction Authority (BCA).

Overview of other building assessment systems

(Not covered by comparison analysis)

The system is broken down into the following categories:

- Energy efficiency
- Water efficiency
- Site / project development & management (Building management & operation for existing buildings)
- Good indoor environmental quality & environmental protection
- Innovation

The system may be used to assess new and operational buildings and both residential and non-residential buildings. Assessments are carried out by the BCA (although they may be assisted in this process by a Certified Green Mark Manager or Professional) and are then rated on a scale of Certified, Gold, Gold Plus or Platinum.



HK BEAM
Hong-Kong

HK BEAM is a voluntary assessment system owned and operated in Hong Kong by the HK BEAM Society and was largely based on the UK BREEAM system. It is possible to assess all building types at both design and operational stages.

The system is broken down into the following categories:

- Site aspects
- Materials aspects
- Energy use
- Indoor environmental quality

Assessments are carried out by a licensed assessor organisation and buildings are rated on a scale of Bronze, Silver, Gold or Platinum.



LIDER A
Portugal

The LiderA (Lead for the Environment in Sustainable Building) system is a voluntary assessment system operated in Portugal. The system can be used to assess a wide range of building types from the design stage through to operational stage.

The system is broken down into the following categories:

- Site and integration
- Resource consumption efficiency
- Environmental loadings
- Indoor environment
- Durability and accessibility
- Environmental management and innovation

Buildings are rated on a scale of A to G.



MINERGIE
Switzerland

MINERGIE is an environmental assessment system for new and refurbished buildings operated in Switzerland by the Minergie Building Agency.

There are a number of complementary products in the MINERGIE range of which MINERGIE is the basic tool which covers:

- Building envelope
- Fresh air / ventilation rates
- MINERGIE limits for energy index
- Thermal comfort
- Building technology

In addition it is necessary to limit the investment in 'sustainable technologies' to no more than 10% above that for a conventional building.

The MINERGIE Eco assessment builds on the MINERGIE assessment and covers the following additional aspects:

- Lighting
- Internal environment
- Indoor air quality
- Resources
- Emissions
 - Recycling



PromisE
FINLAND

The PromisE system was developed in Finland by the Ministry of the Environment with the support of VTT and other industry stakeholders. The system was developed to allow the environmental assessment and classification of new and existing buildings and covers apartments, office buildings and retail premises.

The assessment system is divided into four main categories:

- Health of users
- Consumption of natural resources

Overview of other building assessment systems

(Not covered by comparison analysis)

-
- Environmental loadings
 - Environmental risks

These main categories are then described as subsystems with their content explained more in detail and are rated on a scale of A to E. The classification structure is generic, but tailored to meet the specific needs of different building types at a low level. A web-based software tool assists the assessment and documentation.



SBAT – SUSTAINABLE BUILDING ASSESSMENT TOOL

SOUTH AFRICA

The Sustainable Building Assessment Tool was developed by the Council for Scientific Research (CSIR) in South Africa in around 2001. It was developed to meet the needs of a developing country and to support sustainable development. It describes 15 sets of objectives under the headings of economic, environmental and social, expressing the results on a spider diagram which recognises 5 performance levels for each objective.

Economic: Economy, efficiency of use, adaptability, flexibility, running costs, capital costs

Environmental: Water, energy, waste, site, materials and components

Social: Occupant comfort, inclusive environments, access to facilities, participation and control, education, health and safety.

Overview of other frameworks and methodologies

This section covers all those methodologies that fall outside the scope of certified building assessment systems, such as;

- frameworks i.e. those which are not full assessment systems.
- systems for building components and infrastructure projects.
- environmental or sustainability standards.
- assessment systems currently under development.

CEEQUAL

CEEQUAL, the Civil Engineering Environmental Quality and Award Scheme, is an assessment and awards scheme for improving sustainability in civil engineering and public realm projects. Its objective is to encourage the attainment of environmental excellence in civil

engineering, and thus to deliver improved environmental and social performance in project specification, design and construction.

The system uses a points-scoring-based assessment, which is applicable to any civil engineering or public realm project and includes environmental and social aspects such as the use of water, energy and land, impacts on ecology, landscape, neighbours, archaeology, as well as waste minimization and management, and community relations and amenity. Awards are made to projects in which the clients, designers and constructors have gone beyond the legal and environmental minima, to achieve distinctive environmental standards of performance.

Assessments are carried out by trained assessors who are responsible for scoping the credit issues to be addressed (in consultation with the CEEQUAL verifier). The assessor then completes the assessment and submits it to the verifier for review and approval. Once the verifier is satisfied with the assessment the CEEQUAL certificate is issued.

Further information on CEEQUAL can be found at:

www.ceequal.com

DGNB Certificate

The DGNB certification system is currently being developed by expert groups, which reflect the entire value chain of the construction industry. The expert groups consist of not only construction professionals such as architects, engineers, building physicists, environmental consultants, energy consultants, but also building products manufacturers, investors and scientists. The intention is to translate the practical experience of these individuals into the technical requirements for the award of the certificate.

The criteria of the DGNB certificate use as a basis the results of the Round Table on Sustainable Construction Federal Ministry of Transport, Building and Urban Development (BMVBS). In addition, current standards work on sustainability, quality and quality certifications for construction and environmental declarations (such as the international standard ISO 14025) are taken into account. All of the criteria are intended to be translated into measurable requirements to objectively assess the building quality. economic and socio-cultural issues involved to give all three pillars of sustainability equal consideration.

Further information on the DGNB Certificate can be found at:

www.dgnb.de

EN 15804 (CEN TC350)

The development of EN15804 Sustainability of construction works is currently underway with the majority of sections under development but some under approval. This standard is intended to set out a methodology for the assessment of the sustainability of materials, buildings and construction projects using the Life Cycle Assessment approach. It will comprise of standards covering the following:

- Environmental product declarations - Product category rules
- Environmental product declarations - Communication formats
- Environmental product declarations - Methodology and data for generic data
- Description of the building life cycle
- Assessment of environmental performance of buildings - Calculation methods

- Integrated assessment of building performance - Part 1: General framework
- Integrated assessment of building performance - Part 2: Framework for the assessment of environmental performance
- Integrated assessment of building performance - Part 3: Framework for the assessment of social performance
- Integrated assessment of building performance - Part 4: Framework for the assessment of economic performance

The development of the standard is due to be completed by the end of 2011.

Some further information on CEN TC350 can be found at: www.cen.eu

FIDIC Project Sustainability Management Guidelines

FIDIC's Project Sustainability Management Guidelines were created in order to assist project engineers and other stakeholders in setting sustainable development goals for their projects that are recognized and accepted by as being in the interests of society as a whole. The process is also intended to allow the alignment of project goals with local conditions and priorities and to assist those involved in managing projects to measure and verify their progress.

The PSM Guidelines are structured with Themes and Sub-Themes under the three main sustainability headings of Social, Environmental and Economic. For each individual Sub-Theme a core project indicator is defined along with guidance as to the relevance of that issue in the context of an individual project.

The process follows 4 main stages:

- Stage 1: Establish project specific goals and indicators.
- Stage 2: Adjust project goals and indicators to local conditions
- Stage 3: Test and refine project goals and indicators.
- Stage 4: use project indicators during project implementation, operation and decommissioning.

It is recognized that this process will mean that the guidelines and indicators will constantly evolve with the experience gained and the advance of technologies. It is FIDICs intention that the PSM Guidelines also evolve to take account of this.

Further information on the FIDIC PSM Guidelines can be found at:
www1.fidic.org/resources/sustainability/

Global Reporting Initiative

The Global Reporting Initiative's aim is to make the reporting on economic, environmental, and social performance by all organizations is as routine and comparable as financial reporting.

The Sustainability Reporting Framework provides guidance for organizations to use as the basis for disclosure about their sustainability performance, and also provides stakeholders a universally-applicable, comparable framework in which to understand disclosed information. The Reporting Framework contains the core product of the Sustainability Reporting Guidelines, as well as Protocols and Sector Supplements.

The Guidelines are used as the basis for all reporting. They are the foundation upon which all other reporting guidance is based, and outline core content for reporting that is broadly relevant to all organizations

regardless of size, sector, or location. The Guidelines contain principles and guidance as well as standard disclosures – including indicators – to outline a disclosure framework that organizations can voluntarily, flexibly, and incrementally, adopt.

Protocols underpin each indicator in the Guidelines and include definitions for key terms in the indicator, compilation methodologies, intended scope of the indicator, and other technical references.

Sector Supplements respond to the limits of a one-size-fits-all approach. Sector Supplements complement the use of the core Guidelines by capturing the unique set of sustainability issues faced by different sectors such as mining, automotive, banking, public agencies and others.

Further information on the Global Reporting Initiative can be found at:

www.globalreporting.org/AboutGRI/

IPD Environment Code

The IPD Environment Code was launched in February 2008. The Code is intended as a good practice global standard for measuring the environmental performance of corporate buildings.

Its aim is to accurately measure and manage the environmental impacts of corporate buildings and enable property executives to generate high quality, comparable performance information about their buildings anywhere in the world.

The Code covers a wide range of building types (from offices to airports) and aims to inform and support the following;

- Creating an environmental strategy

- Inputting to real estate strategy
- Communicating a commitment to environmental improvement
- Creating performance targets
- Environmental improvement plans
- Performance assessment and measurement
- Life cycle assessments
- Acquisition and disposal of buildings
- Supplier management
- Information systems and data population
- Compliance with regulations
- Team and personal objectives

IPD estimate that it will take approximately three years to gather significant data to develop a robust set of baseline data that could be used across a typical corporate estate.

Further information on the IPD Environment Code can be found at:

www.ipdoccupiers.com/Home/GlobalEstateMeasurementStandards/Measuringenvironmentalimpacts/IPDEnvironmentCode/EnvironmentCodeFAQs/tabid/1639/Default.aspx

ISO 21931

ISO/TS 21931:2006, Sustainability in building construction -- Framework for methods of assessment for environmental performance of construction works -- Part 1: Buildings, is intended to provide a general framework for improving the quality and comparability of methods for assessing the environmental performance of buildings. It identifies and describes issues to be taken into account when using methods for the assessment of environmental performance for new or existing building properties in the design, construction, operation, refurbishment and deconstruction stages. It is not an assessment system

in itself but is intended be used in conjunction with, and following the principles set out in, the ISO 14000 series of standards.

Further information on ISO 21931 can be found at: www.iso.org

SBTOOL

SBTool is the current implementation of a tool formerly known as GBTool, which was launched in 1996. The current system was released in March 2008.

SBTool is a generic framework for rating the sustainable performance of buildings and projects. It may also be thought of as a toolkit that assists local organizations to develop rating systems. Thus, the system does not become a rating tool until a local (authorized) third party has calibrated the system to suit local needs and conditions.

The system allows third parties to establish parameter weights that reflect the varying importance of issues in the region, and to establish relevant benchmarks by occupancy type, in local languages. Thus, many rating systems can be developed in different regions that look quite different, but share a common methodology and set of terms. The main advantage, however, is that an SBTool version developed with local knowledge is likely to be much more relevant to local needs and values than other systems;

- The system covers a wide range of sustainable building issues, not just green building concerns, but the scope of the system can be modified to be as narrow or as broad as desired, ranging from 120 criteria to half a dozen;
- The system has the capacity to support assessments at four distinct stages of the life-cycle and provides default benchmarks suited to each phase;

- SBTool takes into account region-specific and site-specific context factors, and these are used to switch off or reduce certain weights, as well as providing background information.
- Local organizations can calibrate the system for up to three occupancy types out of a total of 18. Users can then apply them separately or in a mixed-use project;
- The system handles large projects or single buildings, residential or commercial, new and existing construction, or a mix of the two;
- Designers can specify performance targets and can score self-assessed performance. Independent assessors can accept these, or can modify them.
- The system has been successfully used to define performance requirements for large projects with a complex range of requirements.
- The system is currently being implemented on a web-based database system.
- Further information on SB Tool can be found at:
www.iisbe.org/iisbe/sbc2k8/sbc2k8-download_f.htm.

Appendix CEN TC350 - LCA-based standards

The European Commission has mandated (Mandate M350) the European Committee for Standardisation (CEN) to develop a suite of standards for the integrated assessment of environmental performance of buildings based on the principle of LCA life cycle assessment

The standards are due to be implemented across Europe from late 2009 onwards. They will provide a voluntary method for delivery of environmental information to support the construction of sustainable works, including new and existing buildings. Not all construction works will be included.

The standards will describe methodologies for assessment; they specifically do not provide or attempt to prescribe benchmarks or levels of performance.

Currently, the programme of work of CEN TC350 comprises the following:

TC350 TGF

prEN 15643-1. Sustainability of construction works – Integrated assessment of building performance. Part 1: General Framework

prEN 15643-2. Sustainability of construction works – Integrated assessment of building performance. Part 2: Framework for the assessment of environmental performance

TC350 WG5

prEN 15643-3. Sustainability of construction works – Integrated assessment of building performance. Part 3: Framework for the assessment of social performance

TC350 WG4

prEN15643-4. Sustainability of construction works – Integrated assessment of building performance- Part 4: Framework for the assessment of economic performance

TC350 WG1

WI 35000011 Sustainability of construction works – Assessment of environmental performance of buildings – Calculation methods

WI 3500003 Sustainability of construction works – Use of environmental product declarations (EN)

TC350 WG2

WI 3500007 Sustainability of Construction Works - Building Life Cycle (TR)

TC350 WG3

prEN 15804 Sustainability of construction works - Environmental product declarations - Product category rules.

WI 3500005 A standard - Sustainability of construction works - Environmental product declarations - Communication formats

WI03500006) A Technical Report - Sustainability of construction works - Environmental product declarations - Methodology and data for generic data.

List of acronyms

AFNOR	Association Française de Normalisation. French National representative at ISO. Company management system, certification and assessment by sector. Owner of the NF Bâtiments tertiaires/logement / Démarche HQE mark. www.afnor.co.uk
AXA	A group of French global insurance companies. With headquarters in Paris, the group operates independently organised companies in many different countries including Western Europe, North America, Asia pacific region and the middle east.
BEE	Building Environment Efficiency.
BEQUEST	Building Environmental QUALity Evaluation for Sustainability. A network supporting a toolkit for developing a sustainable built environment www.informaworld.com
BERR	(Department) for Business, Enterprise and Regulatory Reform
BRE	Building Research Establishment
BRE Trust	Owner of the companies in the BRE Group.
BREEAM	BRE Environmental Assessment Method. The BREEAM family of assessment methods and tools is designed to help construction professionals understand and mitigate the environmental impacts of all types of developments. BREEAM Buildings can be used to assess the environmental performance of any type of building (new or existing). www.breeam.org
CASBEE	Japanese methodology for calculating Building Environmental Efficiency. First developed by IISBE in the form of GBTool. CASBEE can be applied at 4 different stages: Pre-design, new construction, existing buildings and renovation. CASBEE requires data to be publicly displayed on a website. It is a self-assessment check system for raising environmental performance of buildings. 5 different ratings are available. See www.ibec.or.jp/CASBEE
CDC	Caisse des depots et consignations is a French investment bank working for the French government, overseeing tax-exempt savings funds and the French post office.
CEEQUAL	Civil Engineering Environmental Quality Assessment. An assessment method and reward scheme for civil engineering schemes. CEEQUAL compliments BREEAM by providing a means of evaluating the environmental quality of the procurement process beyond buildings and communities. As the civil engineering sector is highly diverse in its outputs, the method focuses on robust processes and target setting procedures within a project rather than setting absolute targets as BREEAM does. www.ceequal.com
CEN	Comite Europeen de Normalisation (European Committee for Standardisation)
CEN TC 350	European Committee for Standardisation, Technical Committee 350 <i>Sustainability of construction works</i>

CIC	Construction Industry Council. The Construction Industry Council (CIC) is the representative forum for the professional bodies, research organisations and specialist business associations in the construction industry. www.cic.org.uk
CIRIA	Construction Industry Research and Information Association www.ciria.org.uk
CLG	(Department) for Communities and Local Government (replaced ODPM in 2006)
CONAVI	Comisión Nacional de Vivienda - the national housing commission of Mexico
CPET	Central Point of Excellence in Timber, established by UK government to review a host of materials sourcing labelling schemes including FSC, PEFC, CSA and SFI.
CRISP	Community Regeneration and Improvement Special Programme for Northern Ireland. CRISP is targeted at communities located within designated disadvantaged areas in Northern Ireland. www.qub.ac.uk
CSH	Code for Sustainable Homes launched December 2006
CSTB	French industrial and commercial public body under supervision of the Ministry of Sustainable Development. Www.cstb.fr
DEFRA	Department of Environment, Food and Rural Affairs (UK Government)
DEFRA	Department of Environment, Food and Rural Affairs (UK Government)
DER	Dwelling Emission Rate: estimated carbon dioxide emissions in kg/m2/yr from energy use heating, hot water and lighting.
DETR	Department of Environment, and Transport (UK Government) replaced by DEFRA and ODPM
DETR	Department of Environment, and Transport (UK Government) replaced by DEFRA and ODPM
DQI	Design Quality Indicator. A tool to measure the design quality of buildings. www.dqi.org.uk
EA	Environmental Assessment
EC	European Community
ECO-BAU	An association of some 30 members publishing tools in French and German for development of ecological and healthy buildings. Based in Switzerland. www.eco-bau.ch
EcoHomes	BRE Environmental Assessment Method applied to housing
EEA	European Environment Agency www.eea.europa.eu
EIA	Environmental Impact Assessment
EiA	Environmental Impact Assessment

List of acronyms

ENVEST	ENVEST is a software tool that simplifies the complex process of designing buildings with <i>both</i> low environmental impact and whole life costs. The current version ENVEST 2, allows both environmental and financial issues to be optimised by a client to achieve best value. More information is available from www.bre.co.uk .
EPD	Environmental Product Declarations
EQUER	EQUER is a life cycle simulation tool providing quantitative indicators of environmental quality
ESCALE	Assessment method of buildings' environmental performance, CSTB, France. A design stage assessment method for buildings focussing on impacts outdoors and to occupants' health. 11 working criteria result in a partially aggregated profile of performance scores.
FSC	Forest Stewardship Council. Established in 1990, the FSC is an independent, non-government, not for profit organisation which has been established to promote the responsible management of the world's forests. It provides standard setting, trademark assurance and accreditation services for companies and organisations interested in responsible forestry. Products are marked with the FSC label and independently certified to assure consumers that they come from forests which are managed to meet the social, economic and ecological needs of both present and future generations. www.fsc.org
GBCA	Green Building Council of Australia
GBTool	www.greenbuilding.ca Green building tool
GDP	Gross Domestic Product
Greenstar	An environmental assessment method for buildings derived from BREEAM. The first version was developed in 2003 in a partnership between Sinclair Knight Merz and BRE. Greenstar is similar to BREEAM, but reflects important differences between Australia and the UK such as climate, local environments and the construction industry standard practice. Greenstar may be applied by any member of a design team or wider project team. Third party certification is required before the results may be published and a minimum mandatory rating achieved. www.gbca.org.au/green-star
HIP	A Home Information Pack or HIP for short is a pack of documents anyone selling their house must provide to the prospective buyer. www.explorehomeinformationpacks.co.uk .
HQE	Haute Qualite Environnementale (High environmental quality). A French national certification system for residential and non-residential buildings including offices, schools, hotels and shopping centres. For information see www.assohqe.org .
IISBE	International initiative for a sustainable built environment
ISO	International standards organisation
LCA	Life cycle analysis
LCC	Life cycle costing

LEED	LEED is Leadership in Energy and Environmental Design. It was established by the United States Green Building Council to improve the way the construction industry assesses sustainability issues by providing a simple easy to use label. Four ratings are available depending on performance, Certified, Silver, Gold and Platinum. www.usgbc.org
LEGEP	LEGEP Tool for integrated lifecycle performance of buildings: www.legoe.de
LEnSE	Methodology development towards a label for Environmental, Social and Economic buildings. A 6th Framework project co-funded by the EC, developed a list of key issues for assessing the sustainability of any building type.
ODPM	Office of Deputy Prime Minister (replaced by CLG in 2006)
OGC	Office of Government Commerce, part of the UK Treasury
PPS	Planning Policy Statement
PPS 1	Delivering sustainable development
PRESCO	European thematic network PRESCO Practical Recommendations for Sustainable Construction. Established to define a European code of practice for sustainable building. Project covered all phases of building life cycle; inception and feasibility; design and construction, use, refurbishment, decommissioning, dismantling and disposal. Compared 9 building assessment tools www.empa.ch
Protocollo ITACA	Istituto per l'innovazione e trasparenza degli appalti e la compatibilit� ambientale. Italian environmental assessment method owned and run by the Federal Association of the Italian Regions. www.itaca.org
RDA	Regional Development Agency
SBA	Sustainable Buildings Alliance was established to provide sustainable solutions to companies committed to achieving sustainable real estate objectives. www.sballiance.org
SBAT	Sustainable Building Assessment Tool. Developed by the Council for Scientific and Industrial Research (CSIR), South Africa in 2001 to support implementation of more sustainable building and construction in developing countries. Places a strong emphasis on social and economic sustainability as well as environmental www.csir.co.za
SPeAR®	SPeAR® is the Sustainable Project Appraisal Routine. Developed by Arup to demonstrate the sustainability of a project, process or product to be used either as a management information tool or as part of a design process. It is based on a four quadrant model based on environmental protection, social equity, economic viability and efficient use of natural resources. www.arup.com/environment
Sustainability Checklist	Developed by BRE to enable Regional Development Agencies in UK to set broad sustainability targets including economic and social issues as well as environmental issues www.bre.co.uk

List of acronyms

UKGBC	United Kingdom Green Building Council www.ukgbc.org
UN	United Nations
UNEP	United Nations Environment Programme. Mandate is to co-ordinate the development of environmental policy consensus among member states by keeping the global environment under review and bringing emerging issues to the attention of governments and the international community. It reports to the UN General Assembly through the Economic and Social Council. www.unep-wcmc.org
UNEP DTIE	UNEP Division of Technology, Industry and Economics helps governments, local authorities and other decision makers in business and industry to develop and implement sustainable development policies and practices
UNEP FI	UNEP finance Initiative
UNEP FI PWG	UNEP FI Property Working Group
UNEP SBCI	UNEP Sustainable Building and Construction Initiative is a partnership between the UN; private sector; research organisations (government and non-government). Its purpose is to promote sustainable building and construction globally. www.unepsbci.org
USGBC	Green Building Council of the United States of America
WorldGBC	World Green Building Council Movement is a union of national councils with the mission to accelerate the transformation of the global built environment towards sustainability. World Green Building councils represent over 50% of global construction activity associated with more than 15,000 companies and organisations worldwide.
WWF	World Wildlife Fund Work to conserve biodiversity and address threats to the environment by working with people for sustainable solutions www.org.uk
WWF one planet living	A campaign by WWF to bring people together to make changes to their lives by inspiring individuals, businesses and government to contribute jointly to the reduction of environmental impacts by moving from a three planet lifestyle to a one planet lifestyle. www.wwf.org.uk

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Notes and references:

The versions of BREEAM used for this analysis were BREEAM 2008 (design, fit out and post construction stages) and BREEAM 2006 (operational stage).

The versions of CASBEE used for this analysis were CASBEE NC (new construction) and CASBEE EB (Existing Buildings).

The version of Green Star used for this analysis was Green Star v3 (design and as built).

The versions of HQE used for this analysis were TBC.

The versions of LEED used for this analysis were LEED for New Construction & Major Renovations (version 2.2); LEED for Existing Buildings and LEED for Homes.

The versions of Protocollo ITACA used for this analysis were TBC.

It should be noted that in April 2007 the use of EcoHomes on new homes constructed in England was replaced by requirement to use the Code for Sustainable Homes (owned by the department for Communities and Local Government and operated under license by BRE Global). The EcoHomes methodology is currently still in use for refurbished housing in the UK and new housing in Scotland and Wales. Further information on the Code for Sustainable Homes is available at:

www.planningportal.gov.uk/England/professionals/en/1115314116927.html

As of 31st March 2008.

The information in this section is based on a paper titled 'Ecoprofile for Commercial Buildings' by Trine Dyrstad Pettersen (February 2000).

The information in this section is based on that available on the Taiwan Green Building Council website, www.taiwangbc.org.tw

The information in this section is based on that available on the Green Globes website, www.greenglobes.com

The information in this section is based on that available on the BCA Green mark website, www.bca.gov.sg/GreenMark/green_mark_buildings.html

The information in this section is based on that available on the LiderA website, www.lidera.info

The information in this section is based on that available on the Minergie website, www.minergie.com

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Bibliography:

Adair, A. and Hutchison, N., 2005, The reporting of risk in real estate appraisal property risk scoring, Journal of Property Investment & Finance, Vol. 23, No. 3, 2005, pp. 254-268.

Adams, J., 2005b, Big ideas: Risk [online], From New Scientist Print Edition, 17 September 2005, <http://www.geog.ucl.ac.uk/~jadams/publish.htm>

Adams, J., 2005b, Risk Management: it's not rocket science - it's much more complicated.

Agg Regain. BREEAM Offices. Step 3: Credit Calculations.

AI, 2001, The Appraisal of Real Estate, 12th edition, published by: The Appraisal Institute, Chicago.

American Forest & Paper Association (AF&PA). Wood Products: Green Building. http://www.afandpa.org/Content/NavigationMenu/Wood_Products/Green_Building/Green_Building.htm

American Forest & Paper Association. Green Building Fact Sheet: Wood and the Greening of Commercial and Residential Buildings.

http://www.afandpa.org/Content/NavigationMenu/Wood_Products/Green_Building/Green_Building/Green_Building_Fact_Sheets/GBfact2.pdf

American Institute of Architects (AIA) Seattle Chapter.

http://www.aia-seattle.org/notables_and_heroes.htm%23Kudos

American Institute of Architects (AIA). 2005. Green/High-Performance Building Resources.

http://www.aia.org/adv_st_green_highperformance

Annex 31. October 2001. Directory of Tools: A Survey of LCA Tools, Assessment Frameworks. Rating Systems, Technical Guidelines, Catalogues, Checklists and ARUP. 2006. SPeAR®: Product overview.

<http://www.arup.com/environment/feature.cfm%3Fpageid=1685>

ATHENA Sustainable Materials Institute, ATHENA™ Institute International. March 2002. US Federal and Military Applications of LEED: Lessons Learned.

<http://www.athenasmi.ca/projects/leed/docs/LLL%2520Report.pdf>

ATHENA Sustainable Materials Institute. September 2002. LEED Canada Adaptation and BREEAM/Green Leaf Harmonization Studies: Part I Project Summary and Overview Observations.

http://www.athenasmi.ca/projects/leed/docs/PartI_LEED_CanadaHarm.pdf

August 31, 2003. The Sustainable Building CD: Users Manual.

<http://www.sustainablebuildings.co.za/introduction/SB%2520manual.pdf>

Australian Building Greenhouse Rating. 2004.

Acknowledgments, notes, references & bibliography

<http://www.abgr.com.au/new/default.asp>

Australian Government: Department of the Environment and Heritage. March 17, 2006.

Barkley, L., 2001, Key performance indicators: Primary drivers of information systems design, Journal of Corporate Real Estate, Vol. 3, No. 2, pp. 161-171

Beatham, S., Anumba, C., Thorpe, T. and Hedges, I., 2004, KPIs: a critical appraisal of their use in construction, Benchmarking: An International Journal, Vol. 11, No. 1, pp. 93-117

Bespoke BREEAM. 2006. http://www.breeam.org/bespoke.html%20and%20%20http://www.breeam.org/pdf/Bespoke%2520Guidance%2520-%2520For%2520Clients_v1.1.pdf

Boecker, John, Joel Ann Todd, Ann Kosmal, "A Decade of Green Building Rating Systems: Lessons Learned", presented at GreenBuild, Atlanta, GA, November 2005.

Bon, R., McMahan, J.F. and Carder, P., 1998, Property performance measurement: from theory to management practice, Facilities, Vol. 16, No. 7/8, pp. 208-214

BREEAM Offices. Step 4: BREEAM Ratings. Accessed March 2006c.

http://www.aggregain.org.uk/sustainability/examples_of_tools_and_approaches/breeam%20%20/breeam_offices_4.html

BREEAM: Building Research Establishment's Environmental Assessment Method.

<http://www.breeam.org/>

Building Green Inc. March 2005. Green Globes Emerges to Challenge Building Research Establishment Ltd. (BRE Ltd.) Search for BREEAM Offices. <http://www.brebookshop.com/search.jsp>

Cadman, D., 2000, The vicious circle of blame, Cited in: Keeping, M., 2000, What about demand? Do investors want 'sustainable buildings'?

Published by: The RICS Research Foundation.

http://www.rics.org/Practiceareas/BuiltEnvironment/Sustainableconstruction/what_about_the_demand_20000101.html

Canadian Standards Association. 2006. Building Materials and Structural Products Certification Program.

CASBEE for New Construction Technical Manual, March 2004 Edition and Software CD 2004 Edition.

<http://www.ibec.or.jp/CASBEE/english/>

CASBEE Web Site (in English). 2006.

<http://www.ibec.or.jp/CASBEE/english/>

Castells, M., 1996, The Rise of the Network Society, The Information Age: Economy, Society and Culture, Vol. I, Blackwell Publishing, Cambridge

Center for Sustainable Building Research (CSBR). 2005. The State of Minnesota Sustainable

Building Guidelines (MSBG): Buildings, Benchmarks & Beyond. College of Architecture and landscape Architecture – University of Minnesota.

<http://www.csbr.umn.edu/B3/index.html>

Certification Is Big With Builders, Tenant; Critics See a 'Broken' System. The Wall Street Journal Online. (members only).

<http://online.wsj.com/article/SB112967950603172567.html>

Chicken, J. C. and Posner, T., 1999, The Philosophy of Risk, Thomas Telford Ltd, London

Cole, Raymond J. February 1, 2001. A Building Environmental Assessment Method for British Columbia. Environmental Research Group, School of Architecture University of British Columbia.

Comprehensive Assessment System for Building Environmental Efficiency (CASBEE), Japan Sustainable Building Consortium brochure.

CSIR Building and Construction Technology Sustainable Buildings Group FPM.

CSTB-Centre Scientifique et Technique du Bâtiment. 2006. Sustainable Development.

<http://international.cstb.fr/frame.asp%3FURL=research/default.asp>

Denton, D.K., 2005, Measuring relevant things, International Journal of Productivity and Performance Management, Vol. 54, No. 4, pp. 278-287

DeStefano, Jim. August 2005. Understanding Green Building Rating Systems. Structure Magazine.

<http://www.structuremag.org/archives/2005/August%25202005/Understanding-Green-%20%20Building-Ratings.pdf>

ECD Energy and Environment Canada Ltd. February 2002. LEED Canada Adaptation and BREEAM/Green Leaf Harmonization Studies: Part

III BREEAM GREEN LEAF HARMONIZATION STUDY.

http://www.athenasmi.ca/projects/leed/docs/Part_III_Harmoniz_Rpt.pdf

Ellison, L., Sayce, S. and Smith, J., 2007, Socially Responsible Property Investment: Quantifying the relationship between Sustainability and Investment Property Worth, Journal of Property Research, Vol. 24, No. 3, pp. 191-219

Energy and Resources Institute. November 24, 2005. TERI-GRIHA (TERI-Green Rating for Integrated Habitat Assessment).

<http://www.sustainable%20%20buildings.org/files/TL54.pdf%3FPHPSESSID=3f99fa29b907568d3a2438e142a648ba>

Energy Star. September 27, 2005. Tools of Trade: ENERGY STAR Collaborates with the New Jersey Chapter of USGBC on Energy Workshop.

https://www.energystar.gov/index.cfm%3Fc=new_bldg_design.ne

Acknowledgments, notes, references & bibliography

[w_bldg_design
%20%20_news](http://www.bldgdesign.com/news)

Energy Tech. 2006.
Ecobuilding - Building
Optimisation with Total
Quality (TQ) Assessment.

[http://www.energytech.at/
static/architektur/
publikationen/results/
id1772.html](http://www.energytech.at/static/architektur/publikationen/results/id1772.html)

Environment and
Development Foundation
(EDF). 2006. Greenmark
Program.

[http://greenmark.epa.gov.tw/
english/index.asp](http://greenmark.epa.gov.tw/english/index.asp)

Ervin, Christine. May 25,
2005. Pressure on LEED:
Threat or Boon? Greener
Buildings.

[http://www.greenerbuildings.com/
news_detail.cfm](http://www.greenerbuildings.com/news_detail.cfm)
%3FNewsID=28152

European Commission,
2004, Towards a thematic
strategy on the urban
Environment COM(2004)60,
Brussels, 2004, Available at:
European Thematic Network
on Construction and City
Related Sustainability
Indicators. 2006. CRISP

Sustainable Construction
Indicators Database.

[http://crisp.cstb.fr/
db_ListIS.asp](http://crisp.cstb.fr/db_ListIS.asp)

Executive Order 13101.
Greening the Government
through Waste Prevention,
Recycling, and Federal
Acquisition.

Executive Order 13123.
Greening the Government
through Efficient Energy
FABER MAUNSELL.
BREEAM: FAQ. Accessed
March 2006.

[http://www.fabermaunsell.com/
Resources/40/87/index.jsp](http://www.fabermaunsell.com/Resources/40/87/index.jsp)

Federation of Master
Builders. January 22, 1999.
Minister Unveils BREEAM
'98.

[http://www.fmb.org.uk/
publications/masterbuilder/
november98/breeam.asp](http://www.fmb.org.uk/publications/masterbuilder/november98/breeam.asp)

Five Winds International. July
2004. Environmental
Concepts and Tools: Green
Building Design.

[http://www.fivewinds.com/
uploadedfiles_shared/
GreenBuildingDesign040127.
pdf](http://www.fivewinds.com/uploadedfiles_shared/GreenBuildingDesign040127.pdf)

Forest Stewardship Council.
2006. <http://www.fscus.org>

Frangos, Alex. October 19,
2005. Is It Too Easy Being
Green? Eco-Friendly
French, N. and Gabrielli, L.,
2004, The uncertainty of
valuation, Journal of Property
Investment & Finance, Vol.
22, No. 6, 2004, pp.
484-500

Fuerst, F. and McAllister, P.,
2008, Green Noise or Green
Value? Measuring the Price
Effects of Environmental
Certification in Commercial
Buildings [online], Available
at:

GBI. Accessed February
2006c. Not available as of
February 24, 2006. Green
Globes:Assessment and
Rating System: Program
Summary and Users Guide.
[http://www.thegbi.com/
commercial/greenglobes/
pdf/U.S.Summary-Final.pdf](http://www.thegbi.com/commercial/greenglobes/pdf/U.S.Summary-Final.pdf)

GBI. Accessed March
2006b. Green Globes
webpage.
[http://www.thegbi.com/
greenglobes/](http://www.thegbi.com/greenglobes/)

GBTool 1998, 2000, 2002,
2005 and applicable
Manuals.

Geissler, Susanne, and M.
Bruck. Total Quality (TQ)
Assessment as the Basis for
Building Certification in
Austria.

[http://www.argetq.at/
zertifikat/materialien/
tq_oslo.pdf](http://www.argetq.at/zertifikat/materialien/tq_oslo.pdf)

Gibberd, Jeremy, et al. 2005.
Assessing Sustainable
Buildings in Developing
Countries - The Sustainable
Building Assessment Tool
(SBAT) and the Sustainable
Building Life Cycle. SB05,
Tokyo, Japan.

Gibberd, Jeremy. 2003.
Developing a Sustainable
Development Approach for
Buildings and Construction
Processes. CIB International
Conference on Smart and
Sustainable Built
Environment.

Green Building Challenge
(GBC). 1998. Conference
Proceedings. Vancouver,
British Columbia, Canada.
Green Building Council
Australia. 2006. Green Star.

[http://www.gbcaus.org/
greenglobes/page.asp](http://www.gbcaus.org/greenglobes/page.asp)
%3Fid=117

Green Building Council
Korea. 1999. Green Building
Rating System.

[http://www.gbc-korea.co.kr/
eng-8.asp](http://www.gbc-korea.co.kr/eng-8.asp)

Green Building Initiative
(GBI). Accessed May 2006a.
Energy & Environmental
Performance Assessment
and Benchmarking of
Buildings. Green Globes (GG)
webcast.

[http://www.thegbi.org/
greenglobes/pdf/
webcast.pdf](http://www.thegbi.org/greenglobes/pdf/webcast.pdf)

Green Globes. 2006a. GEM
UK - Environmental
Assessment of Buildings.

[http://www.greenglobes.com/
existing/homeuk.asp](http://www.greenglobes.com/existing/homeuk.asp)

Green Globes. 2006b. Green
Globes USA, Green Globes
Canada, GEM UK.

<http://www.greenglobes.com/>

Gruppo di lavoro
interregionale in materia di
bioedilizia 2004. ITACA.

Hartenberger, U. and Lorenz,
D., 2008, Breaking the
Vicious Circle of Blame -

Making the Business Case
for Sustainable Buildings,
RICS FIBRE Series, June
2008

Herz, Johnathan. Public
Architecture and LEED:
Making It Green AND Fair.
The American Institute of
Architects. Accessed
January 2006.

[http://www.aia.org/
pa_a_20041204_LEED](http://www.aia.org/pa_a_20041204_LEED)

HKBEAM Society. 2003. HK-
BEAM: The Hong Kong
Building Environmental
Assessment Method.

[http://www.hk-beam.org.hk/
general/home.php](http://www.hk-beam.org.hk/general/home.php)

Hong Kong (HK) Special
Administration Region
Government, Buildings
Department. 2005.
Comprehensive
Environmental Performance
Assessment System for
Buildings: New Assessment
Method for Building
Sustainability in High Density
Urban Context, Brochure
distributed at SB05.

IEA-BCS Annex 31. February
19, 2002. Finland Energy
certification for residential
and office buildings.

Acknowledgments, notes, references & bibliography

<http://www.uni-weimar.de/scc/PRO/TOOLS/fin-certification.html>

IISD-International Institute for Sustainable Development. Indicators for sustainable development: Theory, Method, Applications - a report to the Balaton group. International Conference on Sustainability Measurement and Modelling ICSMM 06. International Initiative for a Sustainable Built Environment. March 2004. Advanced Building News. ISO. 2004. CD 21929 Building construction – Sustainability in building construction – Sustainability Indicators: ISO. ISO. 2004. CD 21931 Building construction – Sustainability in building construction – Framework for assessment of environmental performance of building BREEAM Offices. Waste & Resources Action Programme (WRAP). Internet resources: Issaquah Highlands. 2006. Blakely Hall Receives Dual Green Certifications.

IVSC, 2005, International Valuation Standards 2005, International Valuation Standards Committee, London
James, Peter, and D. Somervell. April 29, 2004. Assessing the Environmental Performance of Buildings in Higher Education. Summary of a HEEPI workshop, University of Leicester.
Jones Lang Lasalle: Green Building Rating Systems: Going Beyond the Labels – October 2008. www.sballiance.org
Jones, K. and White, A.D. (Eds.), RICS Public Sector Asset Management Guidelines – A guide to best practice, Published by: Royal Institution of Chartered Surveyors, London
JSBC: Japan Sustainable Building Consortium. 2005. CASBEE: Comprehensive Assessment System for Building Environmental Efficiency. <http://www.ibec.or.jp/CASBEE/english/index.htm>
Kishk, M., Pollock, R., Atta, J. and Power, L., 2005, A

structured model for performance assessment in property management, Journal of Financial Management of Property and Construction, Vol. 10, No. 3, pp. 159-169
Labs 21. March, 7, 2006. Labs for the 21st century. <http://www.labs21century.gov/>
Langer, Kenneth, and R. Watson. November 7, 2005. Bringing LEED to China. LEED. Environmental Building News. <http://www.buildinggreen.com/auth/article.cfm?3Filename=140304b.xml>
LEGE®. 2006. LEGE®: Tool for integrated lifecycle performance of buildings.
Lewis, Malcolm, and H. Miranda. 2002. Impacts of a Green Building Rating System on the Design and Construction Process: A Summary of Ten Projects Using LEED™.
Lorenz, D., d'Amato, M., Des Rosiers, F., van Genne, F., Hartenberger, U., Hill, S., Jones, K., Kauko, T.,

Kimmet, P., Lorch, R., Lützkendorf, T. and Percy, J., 2008, Sustainable Property Investment & Management – Key Issues and Major Challenges, Published by: Royal Institution of Chartered Surveyors, London
Lorenz, D., Trück, S. and Lützkendorf, T., 2007, Exploring the relationship between the sustainability of construction and market value – Theoretical basics and initial empirical results from the residential property sector, Property Management, Vol. 25, No. 2, pp. 119-149
Los Angeles Community Colleges (LACC). December 2, 2005. LACCD Project is First in U.S. to Receive BREEAM Certification.
Lützkendorf, T. and Lorenz, D., 2007, Integrating sustainability into property risk assessments for market transformation, Building Research & Information, Vol. 35, No. 6, pp. 644-661. Management. <http://www.wbdg.org/pdfs/eo13123.pdf>

Menger, C., [1871] 2004, Principles of Economics, Translation of ‚Grundsätze der Volkswirtschaftslehre‘ [online], Published by: Ludwig von Mises Institute, Available at: Minnesota Sustainable Communities Network (MSCN), NextStep. October 13, 2005. Minnesota Sustainable Design Guide. http://www.nextstep.state.mn.us/res_detail.cfm?3Fid=71
Murakami, Shuzo. January 20-23rd, 2003. Today's approach for promoting sustainable building in Japan. http://www.asian%20%20%09forum.net/conference_2003/pdf/CASBEE_Murakami_AasianForum.pdf
National Associate of Home Builders (NAHB). 2006. NAHB's Model Green Home Building Guidelines. http://www.nahb.org/fileUpload_details.aspx?3FcontentTypeID=7%26contentID=1994

National Australian Built Environment Rating System (NABERS). 2006. NABERS – Frequently Asked Questions. <http://www.nabers.com.au/nabers/faq.htm>
Natural Resources Canada. April 12, 2005. Buildings Group: C-2000 Program.
Neely, A., 1998, Three models of measurement: theory and practice, International Journal of Business Performance Management, Vol. 1 No. 1, pp. 47-64, cited in: Beatham, S., Anumba, C., Thorpe, T. and Hedges, I., 2004, KPIs: a critical appraisal of their use in construction, Benchmarking: An International Journal, Vol. 11, No. 1, pp. 93-117, Netherlands.
O'Brian, Mary, and J. Nile. 2003. BUILDING BETTER BUILDINGS: The Transition to Environmental Building in Canada.
OECD. 2000. Towards Sustainable Development – Indicators to measure progress. OECD

Acknowledgments, notes, references & bibliography

- Office of Management and Budget (OMB). 2002. "Section 55 – Energy and RICS, 1997, Calculation of Worth – An Information Paper, Royal Institution of Chartered Surveyors, London
- Robert Lechner et al., Total Quality Building (TQB), The Austrian Building Assessment Tool, SB05, Tokyo
- Scheuer, Chris W., and G.A. Keoleian. September 2002. Evaluation of LEED® Using Life Cycle Assessment Methods. Center for Sustainable Systems, University of Michigan. <http://www.bfrl.nist.gov/oae/publications/gcrs/02836.pdf>
- Schwartz, Jerry. January 23, 2005. Steven Winter Associates, Inc. LEED® Cost Study: Final Report. Summarization. Prepared by AF&PA.
- Shendler, Auden, and R. Udall. October 27, 2005. LEED Is Broken; Let's Fix It. <http://www.grist.org/comments/soapbox/2005/10/26/leed/index1.html>
- Shik Shin, Kee. Green Building Certification System in Korea, SB05, Tokyo
- SIRIS & Atchison Consultants, 2008, Building Value - Responsible Property Investment Performance <http://www.siris.com.au/news/files/20080930RPIPerformanceSummaryReport2008.pdf>
- Solomon, Nancy B. How Is LEED Faring After Five Years in Use? Architectural Record: McGraw Hill Construction. Accessed March 2006. <http://archrecord.construction.com/features/green/archives/0506edit-1.asp>
- Steven Winter Associates, Inc. October 2004. LEED® Cost Study: Final Report. <http://www.getf.org/file/toolmanager/CustomQ16C45F60590.pdf>
- Sustainable Building (SB). 2002. Conference Proceedings. Oslo, Norway.
- Sustainable Building (SB). 2005. Conference Proceedings. Tokyo, Japan.
- Sustainable Buildings (SB). 2000. Conference Proceedings. Maastricht, The Netherlands. <http://www.deh.gov.au/settlements/industry/construction/>
- Sustainable Forestry Initiative. March 24, 2006. SFI® Labeling Program. http://64.29.218.149/sfilabel_use.asp
- Sustainable Forestry Initiative® (SFI). Where Can Interested Stakeholders Go for Accurate and Objective Information Comparing Forest certification programs? Sylviane Nibel, et al, ESCALE, Assessment Method of Buildings Environmental Performance, Sustainable Buildings 2000, Maastricht, Netherlands, October 2000
- Sylviane Nibel, et al., French Certification for Non-Residential "High Environmental Quality" Building Projects, SB05, Tokyo;
- Tamm, Elanna. September 30, 2005. Green Building Products. United States Commercial Service.
- Technical Office for the Use of Steel (France). 2006. The HQE® (High Environmental Quality) programme. http://www.otua.org/expertises_sustainable_development6.htm
- TEGoVA, 2003, European Property and Market Rating [online], Published by: The European Group of Valuers Associations. <http://www.tegova.org/reports/EPMB.pdf>
- The Royal Society, 1983, Risk assessment: Report of a Royal Society Study Group, London, Royal Society.
- Timo Rintala and Ilari Aho, PROMISE: Environmental Classification of Buildings: Current Situation and Objectives, June 25, 2003
- Todd, Joel Ann, et al. 2001. "Comparative Assessment of Environmental Performance Tools and the Role of Green Building Challenge," Building Research and Information, (2001) 29(5), 324-335.
- Transportation Efficiency Management." OMB Circular No. A-11 PEFC Council (Programme for the Endorsement of Forest Certification schemes).
- Transportation, Treasury, Housing and Urban Development, the Judiciary, the District of Columbia, and Independent Agencies Appropriations Act, 2006, Public Law.
- Trine Pettersen et al, Ecoprofile – a simplistic environmental assessment method: experiences and new challenges," SB2000, Oslo, Norway
- U.S Army Corp of Engineers, Department of the Army. May 1, 2001. Sustainable Design for Military Facilities. <http://www.usace.army.mil/inet/usace-docs/eng-tech-%20%20-%20%091trs/etl1110-3-491/entire.pdf>
- U.S Army Engineer Research and Development Center. 2000. Sustainable Project Rating Tool (SPiRiT). <http://www.cecer.army.mil/earupdate/nlfiles/2000/sustainable2.cfm>
- U.S. Environmental Protection Agency. Environmental Labeling Issues, Policies, and Practices Worldwide:
- Taiwan's Green Mark Program. <http://www.epa.gov/oppt/epp/pubs/envlab/taiwan.pdf%23>
- U.S. Green Building Council (USGBC). 2006. U.S. Green Building Council.
- UNEP FI, 2007, Demystifying Responsible Investment Performance – A review of key academic and broker research on ESG factors [online], Published by: United Nations Environment Programme Finance Initiative http://www.unepfi.org/fileadmin/documents/Demystifying_Responsible_Investment_Performance_01.pdf
- University of Minnesota - College of Architecture and Landscape Architecture. 2001. Minnesota Sustainable Design Guide.
- USGBC. January, 2006. LEED Product Development and Maintenance Manual.
- USGBC. October, 2005. LEED for New Construction and Major Renovation.
- Von Mises, L., 1949, Human Action – A Treatise On

Economics, 4th edition, Fox
& Wilkes, San Francisco.

Von Woedtke, W., 2008,
AAAvall valuation system
[online], Published by:
AAAcon GmbH.

[http://www.aaacon.de/
content/de/AAAvall_flyer.pdf](http://www.aaacon.de/content/de/AAAvall_flyer.pdf)

Walsh, Bill. August 9, 2005.
Green Building Movement
Shows Its True Colors:
Highlights From The AIA
Sustainability Summit.
Healthy Building Network.

Walsh, Bill. July 19, 2005.
Conflicts of Interest at the
American Institute of
Architects:Trade Associations
Set The Greenwash Agenda.
Healthy Building Network.

BRE

The Building Research Establishment (BRE) is former UK government establishment (but now a trust organisation, funded by the building industry) that carries out research, consultancy and testing for the construction and built environment sectors in the United Kingdom. The BRE is headquartered in Watford with regional sites in Glasgow and Port Talbot.

Among the BRE's areas of interest are participation in the preparation of national and international standards and building codes, including the UK Building Regulations. The organisation is now funded by income from its commercial programmes, the BRE bookshop, contracted work, and by bidding for research funding from government and the industries it serves. It is also a UKAS Accredited Testing Laboratory.

The BRE also owns and operates the BREEAM and EcoHomes environmental rating schemes, and promotes the German Passivhaus ultra-low energy building standard in the UK. It also runs a number of training courses.

BRE's sister company, BRE Global is an independent approvals body offering certification of fire, security and sustainability products and services.

The Building Research Establishment is owned by the BRE Trust, a Charitable organization, which claims to be the largest charity in the United Kingdom dedicated to research and education in the built environment. Trustees are drawn from seven groups: built environment professionals, contractors, material and product suppliers, housing, university departments, building owners, building managers and building users.

For further information: <http://www.bre.co.uk/>

CSTB

CSTB was set up in 1947 as an industrial and commercial public body (known in France as an EPIC), placed under the supervision of the Ministry of Housing, the Directorate General for Urban Development, Housing and Construction, now Ministry for Sustainable development.

About BRE, CSTB and the college of observers

In its quest to improve well-being and safety in buildings, CSTB plies four complementary trades: research, advanced engineering, quality assessment and the dissemination of knowledge.

CSTB collaborates with contracting authorities, architects, research offices, manufacturers and entrepreneurs, and helps the French public authorities to define technical regulations and ensure the quality of buildings. CSTB is a State-owned industrial and commercial corporative and one of Europe's leading research and evaluation centres.

Its experts include specialists in construction materials and techniques, facilities, safety, thermal engineering, acoustics, aerodynamics, lighting, the environment, health, new information and communication technologies, not to mention economics and sociology.

For further information: <http://www.cstb.fr>

About the college of observers

Asset management, bank and insurance companies

AXA

Gilles Bouteloup

AXA (Euronext: CS, NYSE: AXA) is a French global insurance companies group headquartered in Paris and founded in 1985 by Claude Bébéar. AXA is not the name of a single company but a group of companies independently organized and operated according to the regulations of many different countries.

The AXA group of companies are engaged in life, health and other forms of insurance, as well as investment management. The AXA group operates primarily in Western Europe, North America and the Asia Pacific region and the Middle East.

There are five operating business segments with the AXA group of companies: Life & Savings, Property & Casualty, International Insurance (including reinsurance), Asset Management and Other Financial Services.

The combined group has 189,000 employees and US\$122 billion of revenues in 2004. If AXA were a single company it would rank as the 15th largest company in the world (based on revenues) on the 2006 Fortune Global 500 list.[2]

Lend lease

Cate Collins

Janet Kidner

Fiona Parry

Paul Toyne

Lend Lease Corporation Limited is an Australian-based multinational property management and investment company. It was formed in 1951 as "Civil and Civic contractors", an Australian subsidiary of the Dutch building company Bredero's. The present corporate structure began in 1958 with a listing on the Australian Stock Exchange and a change to the current name; Civil and Civic retained a large stake in the new, floated corporation, but was bought out by Lend Lease itself in 1961.

The company operates in more than 40 countries around the world. In all of these, the Bovis Lend Lease division constructs and manages large building projects. Amongst its many commercial projects, the company was involved in the construction of major public buildings such as the Sydney Opera House and Melbourne Park. The company runs additional businesses in certain markets:

In the Asia-Pacific region the company owns the Delfin residential property development group, a major Australian residential property developer mainly concentrating on outer-suburban greenfields suburbs.

Lend Lease also operates a retail development investment business in the UK, the third largest in that market, and is a developer of retail properties in its own right. It also conducts many "public-private partnership" developments with the UK government, particularly concentrating on hospital and defence housing estate developments.

About BRE, CSTB and the college of observers

In the United States, Lend Lease is involved in the development of defence housing through US government privatisation initiatives in this area.

Caisse des dépôts et consignations

Blaise Desbordes

Caisse des Dépôts et Consignations (CDC) serves as an investment bank for the government and oversees tax-exempt savings funds collected by savings banks (caisses d'épargne) and the post office. The group helps millions of French save, investing these deposits in such public projects as subsidized housing and semi-public companies it forms with local governments for urban development. The group runs retirement plans for government employees who are not part of the civil service system. Through its holdings in CNP Assurances (40%), CDC is also one of France's top life insurers. Other operations include CNP Entreprises (private equity) and Société Nationale Immobilière (real estate).

ICADE

David Ernest

Frank Hovorka

Vinh-Nghi Tiet

The company is a property investment and development firm that focuses on housing, commercial property, and public- and health-sector partnerships. It also manages apartments for third-party customers and helps develop half of the hospitals built in France.

The French Bank Caisse des Despots et consignations (owned by the French government) holds some 60% of Icade.

Istrillium

David Farebrother

F&C Asset management

F&C Asset Management plc (LSE: FCAM) is a large British investment management business working for institutional, insurance and retail clients. Established in 2004, the company is a constituent of the FTSE 250 Index.

IGLOO

Robert Knight

David Roberts

The Igloo Regeneration Fund was established in 2002 as the UK's first urban regeneration fund. The United Nations recently referred to Igloo as "The first sustainable property fund in the World". It invests into mixed-use urban regeneration projects in major towns and cities in the UK. The nature of the Fund's activities means that it has strong Socially Responsible Investment (SRI) characteristics. It is jointly managed by Morley and Igloo Regeneration Ltd. The portfolio of projects currently has a completed development value of around £2.5 billion creating around 8,500 homes and nearly 10,000 jobs on about 250 acres of Brownfield land and reducing fossil fuel use by over 50%.

Universities and research centers/consultants

Carnegie Mellon University - USA

Prof. Volker Hartkopf

Since its inception, Carnegie Mellon has grown into a world-renowned institution, with numerous programs that are frequently ranked among the best in the world.

FCAV-University of Sao Paulo – Brazil

Pr. José Joaquim do Amaral Ferreira

USP is one of the largest institutions of higher education in Brazil and Latin America with approximately 75,000 enrolled students. USP is considered as Brazil's top academic and research institute.

About BRE, CSTB and the college of observers

The FCAV is a non profit foundation created in 1967 by the Industrial Engineering Department of the Polytechnic School of University of São Paulo.

Karlsruhe university – Germany

Prof. Dr. Thomas Lützkendorf

Karlsruhe University is a scientific & technical center located in the city of Karlsruhe in Germany and it is recognized as a leading european research university.

The Karlsruhe Institute of Technology (KIT) is the name of a cooperation between the University of Karlsruhe and the Forschungszentrum Karlsruhe (Karlsruhe Research Centre).

Lorenz Property Advisors – Chartered Surveyors

Dr. David Lorenz

Dr. Lorenz Property Advisors is a team of experienced property professionals providing advice on commercial and residential property investment in order to assist in making sustainable property decisions.

UNEP-SBCI

Peter Graham, United Nations Environmental program - Sustainable building and construction initiative.

UNEP-FI

Regina Kessler, United Nations environmental Program - Finance Initiative

FIDIC

Iksan Van Der Putte

FIDIC aims to represent globally the consulting engineering industry by promoting the business interests of firms supplying technology-based intellectual services for the built and natural

environment. Run mostly by volunteers, FIDIC is well known in the consulting engineering industry for its work in defining Conditions of Contract for the Construction Industry worldwide.

iiSBE

Nils Larsson

iiSBE currently has over 400 individual and corporate members from about 30 countries, and its Board comprises 17 individuals from Brazil, Canada, Chile, China, Czech Republic, Denmark, Finland, Germany, Italy, Japan, Korea, Malaysia, New Zealand, Poland, Spain and USA.

Over a period of ten years, iiSBE has led the development of an international assessment method related to sustainable building. This work has been carried out in cooperation with many researchers from more than 20 countries, and results have been displayed at the various international SB conferences held in 1998, 2000, 2002, 2005 and, coming up, in 2008.

ITACA – Italy

Andrea Moro

Itaca runs the Protocollo ITACA, a Government owned rating system with the scientific support of a private organisation (iiSBE ITALIA). The certification activities are performed by the Construction technology institute of the national research center ITC-CNR. The national research center is the greatest public research center in Italy.

DGNB – Germany

Anna Braune

The DGNB is the German Association for the promotion and certification of sustainable building. The german green building council. The council is composed of the Federal Ministry of Transport, Building and Urban Affairs and a private consortium.

Certivea

Christophe Gérard

About BRE, CSTB and the college of observers

Certivéa is a CSTB subsidiary, a 100% private organization that runs the HQE certification for tertiary buildings.

Qualitel - France

Ana Cunha

Qualitel is a public organization that certifies social dwellings and who runs the HQE certification for dwellings. Qualitel & CSTB have created a joint subsidiary that runs the HQE for individual houses.

