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BUILDING ENVIRONMENTAL ASSESSMENT METHODS: IN PRACTICE

Nigel Howard

VP LEED & International, US Green Building Council, 1015 18th St NW, Washington, DC 20036, nhoward@usgbc.org, www.usgbc.org

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Summary

The objective of this paper is to review in outline the current application of building environmental assessment, rating and certification systems internationally. The paper draws on experience Internationally with different assessment and rating systems and draws out key lessons for the development and implementation of these market transformation tools.

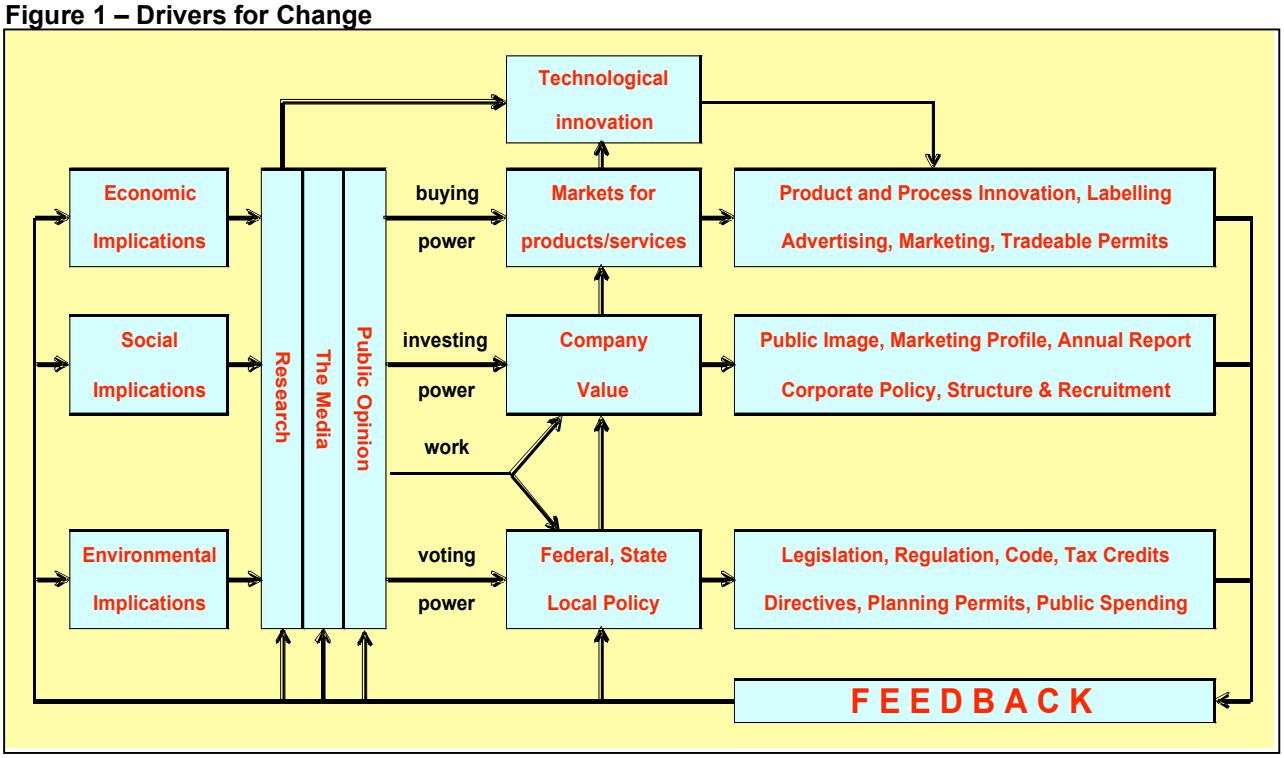
1. Introduction

The imperitive of the decade and certainly of the century is to get to understand and make substantial progress toward sustainable development. Buildings are acknowledged as the 40% sector with transport the 30% sector of impacts. Buildings and their planned co-location crucially affect the majority of our consumption of resources, air, water and land pollution. There is a growing movement of committed practitioners trying to advocate and practice in a more sustainable way. In the US and a number of other countries multi-stakeholder coalitions of practitioners are coming together under the auspices of Green Building Councils to transform national markets toward sustainability. These include commercial and public sector organizations and Federal, State and Local governments. Green Building Councils and other organizations are recognizing the power of environmental assessment, certification and labeling (ideally third party assessed).

2. Understanding Market Transformation

In order to effect market transformation toward sustainable development, it is important to understand the drivers for change. Figure 1 shows the drivers for change arising from a public consultation exercise undertaken in the UK.

Figure 1 – Drivers for Change



The main drivers for change are the impacts that arise from our activities and buildings. These can be environmental, economic or social. The first step is discovery of the impacts and this comes from research. Researchers often understand the impacts in detail, but may be less able to convey these issues to the public. The media play a crucial role in interpreting research to the public. It is important that the media collectively takes a balanced view of the wide range of issues in communicating to the public. The public are the key decision-takers. They make decisions for themselves, for their families and for the companies that they work for. However, there are only 4 types of decision they can make.

Firstly, people can decide the products – buildings and materials that they want to purchase or lease. Assessment and certification labels simplify the complex mix of decisions about the buildings or products to facilitate decisions related to buildings. They allow more sustainable buildings and products to be differentiated in the market and achieve an appropriate premium value and cost. This gives real commercial impetus and motivation to the developers and designers of more sustainable buildings.

Secondly, people can decide where to invest. Socially responsible Investment is proving to out-perform other types of investment AND it is preferred by most investors just because it is the right thing to do, has no financial penalty and is perceived to be lower risk investment. Organizations that can demonstrate their improved environmental performance to investors are more likely to qualify for SRI investment. For most organizations, their biggest impacts arise through their buildings and the commuter transport of employees. Organizations are starting to append environmental reports to their annual reports showing their environmental profiles and reporting their occupation, operation and use of their buildings.

Thirdly, people can decide where they want to work themselves. People prefer to work for organizations that are perceived to be ethical and environmentally responsible. A certification plaque on a building is a potent symbol of the organizations environmental ethic for staff, customers and clients using or visiting the building. Most organizations see their key asset as their employees and the value of business taking place in commercial buildings has been estimated at 2 orders of magnitude larger than the amortized life cycle cost of the building. Moreover, there is emerging evidence that environmentally certified buildings with improved day-lighting, personal control and improved thermal comfort, reduced noise disruption and improved air quality can deliver around 4% improved productivity and improved retention of staff of around 10%. More work is needed to refine and confirm these estimates because of their important implications for the business case for environmentally assessed and certified buildings.

Fourthly, people can vote for public offices. In the US, at all political levels, there is strong non-partisan support for Green buildings. It is noticeable that Local and State politicians are very enthusiastic to participate in the dedication ceremonies for LEED certified buildings. The USGBC has enjoyed excellent support from federal agencies for the development of LEED as a voluntary consensus standard in preference to regulating for improved buildings' performance.

3.0 History of Environmental Assessment

The first simplified environmental assessment and certification system developed internationally was the BREEAM rating system developed in the UK in 1990. Interestingly, the motivation for developing BREEAM came from a group of private sector speculative developers (led by Stanhope plc) wanting to differentiate the quality of their buildings from their competitors in a boom market.

At the same time, the protocols and standards for Life Cycle Environmental Assessment were under development and adaptation from product assessment to buildings assessment. There was a tension between the 2 constituencies – BREEAM was perceived as simplistic, but LCA was perceived as impossibly complex and impractical, especially for buildings which are composites of materials and products which must be reconciled with the lifetime operational performance of the buildings. In many European countries these initiatives continued in parallel and were then reconciled over time – BREEAM now uses LCA based credits for materials used based on comparative elemental LCA profiles.

ISO 14000 for Environmental Management Systems was also launched around this time and later mandated for use by suppliers to the European Commission. This created a potential for coordination between the design and operational performance and management of buildings.

In 2000, Ove Arup launched SPEAR to try to expand the agenda from a predominant environmental focus to include social and economic issues.

For the purpose of this paper, environmental assessment is taking to mean any method of assessing the environmental impact or sustainability of materials/buildings/neighborhoods whilst environmental labeling/certification implies:

- Third party environmental assessment with published performance requirements
- May be subject to legal, commercial and real market factors
- May need to be backed by a consensus process
- May be legally enforced or mandated as policy by government agencies or corporations

4.0 Environmental Assessment Methods used Internationally

Figure 2 shows the emerging diversity of environmental rating and certification methods in use internationally characterized by scope. The list is unlikely to be complete or up-to-date.

Figure 2 Environmental Assessment Methods and Scope

Rating System		Site	Transport	Water	Energy & Atmosphere	Materials & Resources	Indoor Environment
Green Globes	Ca	P		P	P	P	P
NAHB Green Guidelines	US	P	P	P	P	P	P
HK BEAM	HK	P	P	P	P	P	P
SPEAR	Int	P	P	P	P	P	P
BREEAM	UK	P	P	P	P	P	P
LEED	US	P	P	P	P	P	P
Green Stars	Au	P	P	P	P	P	P
Green Building Label	Ta	P	P	P	P	P	P
Korea Green Building Label	Ko	P		P	P	P	P
CASBEE	Ja	P	P	P	P	P	P
GOBAS	Ch	P	P	P	P	P	P
GBTool	Int	P		P	P	P	P
Escale	Fr			P	P	P	P
ENVEST	UK			P	P	P	
LEGEP	Ge						
PromisE	Fi	P	P	P	P	P	P
Equer	Fr	P	P	P	P	P	
ATHENA	Ca/US					P	
Ecoquantum	Nl					P	

The different methods mostly address a similar menu of issues and even the methods of measurement are converging as development groups learn from each other.

Figure 3 – Complexity/Sophistication vs Practicality/Cost

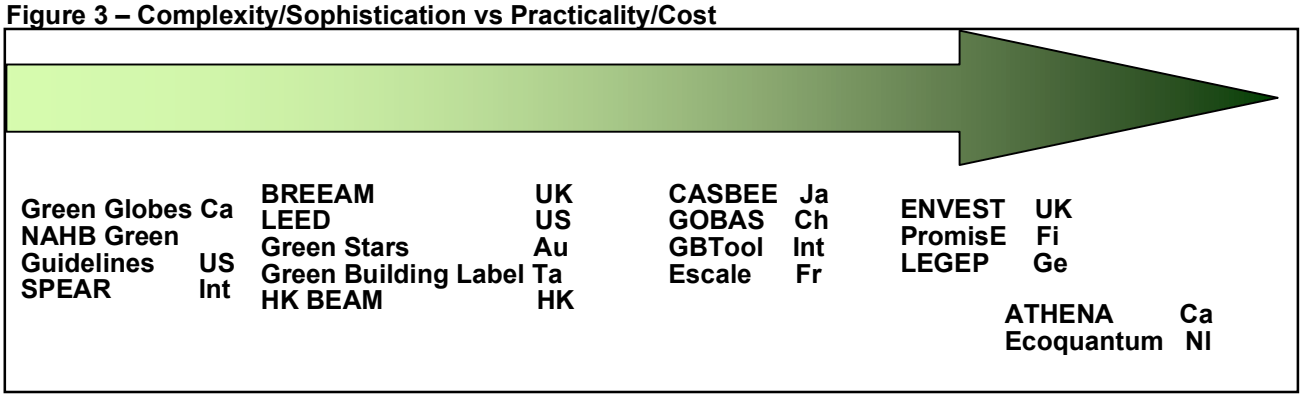


Figure 3 shows the authors approximate characterization of the different tools for their complexity and sophistication with apologies to any authors that feel their tool is mischaracterized. For example the SPEAR tool has the widest scope, but does not cover the issues in the sophisticated way that an LCA might try to address them.

The more sophisticated tools and methods with more LCA based content tend to be smaller in scope because of the burgeoning data requirements and cost. Simpler methods are also more easily comprehended by the market and perceived as easier and more practical to use. Successful environmental rating and certification tools appear to strike a careful, consensus based balance between the conflicting demands for sophistication and practicality. If a tool or method is too simple and proscriptive then it will not be credible to the market. If a tool or method is too complex, then it will appeal to only a small segment of the market willing to invest the time and expense of the sophisticated approach.. This latter group are likely to be the innovators creating the new designs and technologies and future practice.

Figure 4 – Green Building Markets and Positioning – US Market

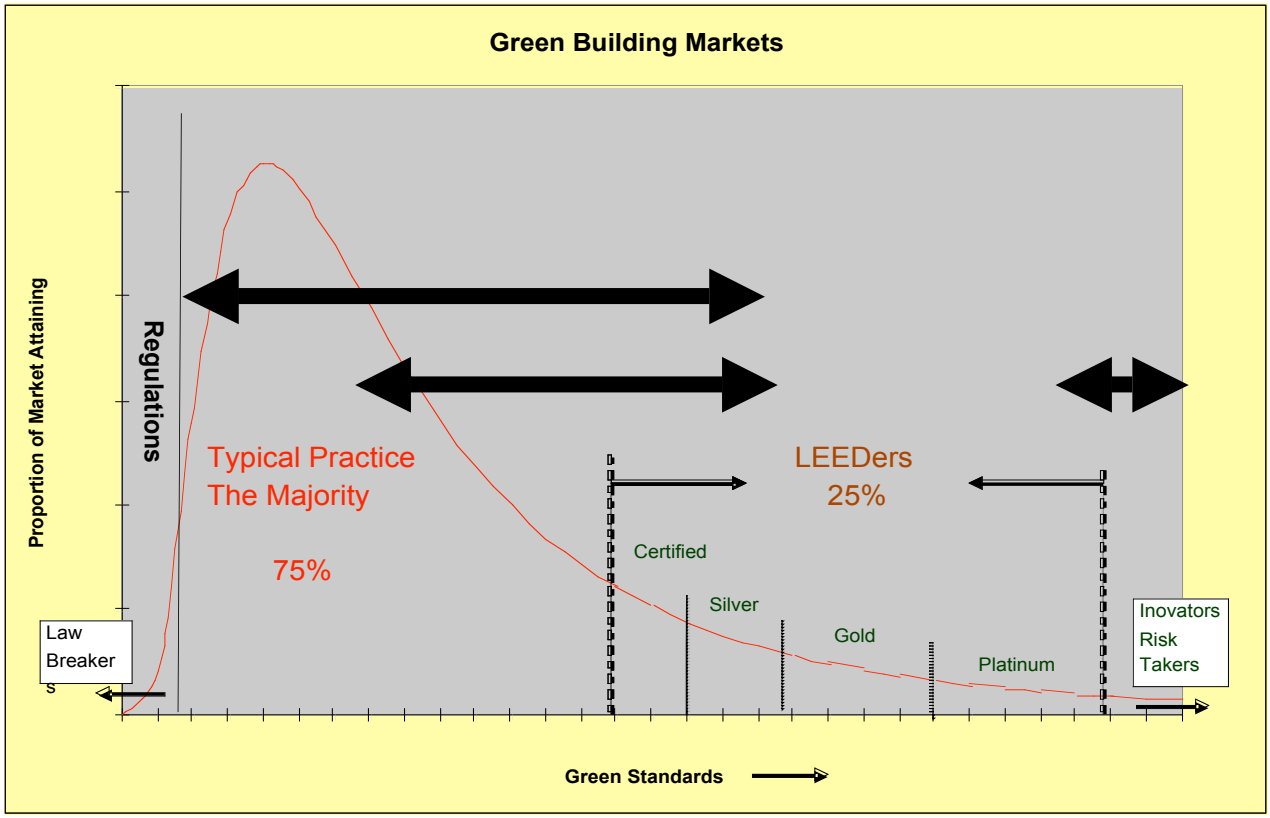


Figure 4 shows a conceptual histogram of "Green" performance which is used by USGBC to conceptualize the market that it is trying to differentiate to promote market transformation. The market is distributed in a skewed distribution, with the majority of the market achieving performance just a little better than regulation. LEED is positioned to reward the top 25% of best practice at 4 different levels to give a progression of incentives for improved performance. Simpler tools can be used and have appeal to most of the market, but the extent to which they differentiate the market to promote change and the extent to which the market finds them credible is probably limited. As mentioned earlier, more complex tools are needed for the innovators creating the platinum practice of the future, but are likely marginalized to use by only a small proportion of the market. In successful rating systems, it appears that an effective compromise is achieved through the engagement of stakeholders in a consensus process between sophistication and practicality.

5 Scope of Environmental Assessment Methods

In order to determine the appropriate scope of an environmental assessment method, it is informative to think about the life cycle phases and the key decision takers during each phase. Figure 5 shows phases in the life cycle of buildings together with the key decision-takers in each phase.

Figure 5 - Scope of Environmental Assessment methods

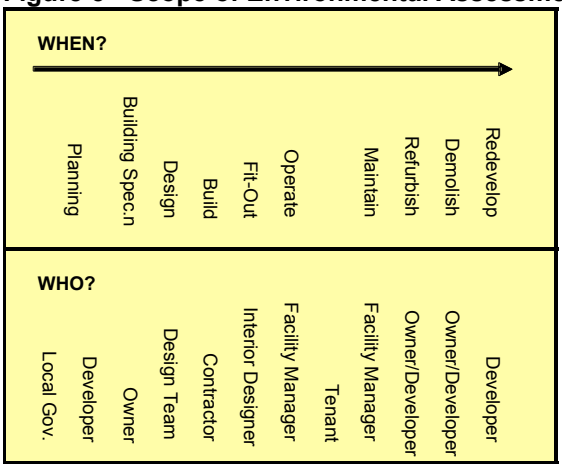


Figure 6 How LEED Versions are Targeted to Sectors and Life Cycle Phases

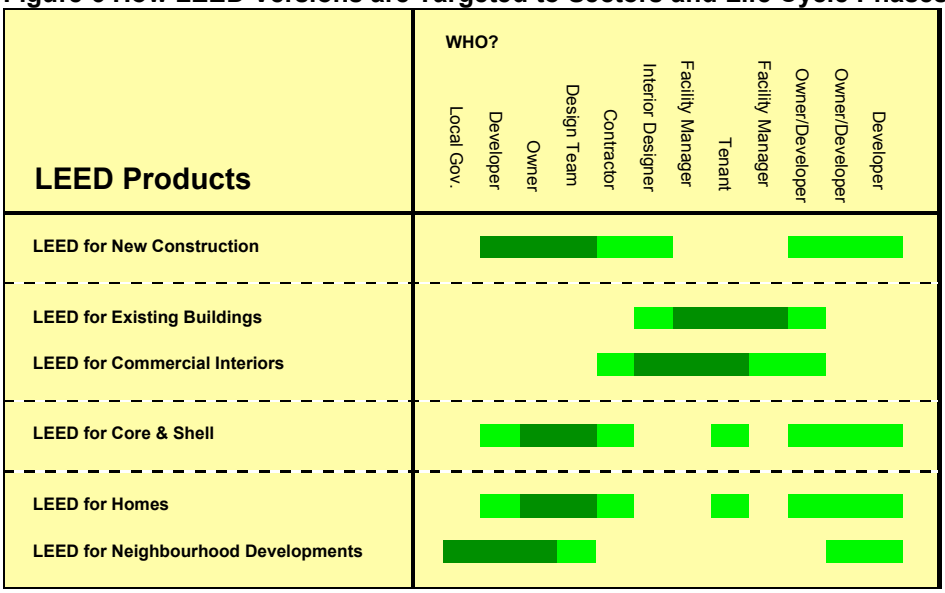


Figure 6 shows how LEED Versions are targeted to decision-takers. The primary targets are represented by the dark bars on the chart, but those also affected are identified by the lighter colored bars. Most environmental rating systems developed internationally are targeted toward the commercial sector and primarily offices. Some are targeted toward housing, but for this sector it is harder to reconcile the cost of assessment with the commercial value of the certification to the homebuilder. Successful environmental assessment methods target a specific phase in the life of buildings and target just the decisions that the key decision-makers can take to influence the building's performance.

6 Some Examples of Environmental Assessment Methods

In this section some examples of environmental assessment methods are highlighted because they offer lessons for others. This is not a complete review but illustrative of the range of methods and some interesting aspects.

6.1 BREEAM - UK

BREEAM was the first method developed and has been refined through more cycles of iteration and improvement than other methods. The special features of BREEAM which are note-worthy include:

Use of an ecological index for sites – this is based on plant species counts in different landscape types with different land uses. The credit works very effectively because it recognizes in a very straight-forward way the ecological diversity of the site prior to development/redevelopment as well as the ecological diversity

post development. It promotes the use of low diversity sites (agricultural sites are often low diversity sites) over high (natural sites, especially older growth and coppice managed forest), it encourages the redevelopment of derelict sites and encourages landscaping sensitive to enhancing local ecology.

Reconciling Commuter Transport and Buildings' Operational Energy – based on CO2 emissions, this credit takes account of location, access to public transport, availability of car-parking spaces, provision of car share, bicycle storage, showers and lockers to determine CO2 commuter transport. The operational energy related CO2 emissions are derived from fuel mix and CO2 per fuel used. These trade off depending on location and typically the inner city naturally ventilated building earns maximum credits, then there is an interesting trade-off between the inner city (polluted, noisy, heat island afflicted site) air-conditioned building with the suburban (unpolluted, quiet site) that is naturally ventilated.

Use of Simplified Elemental LCA (Green Guides to Specification) - to reconcile LCA based material credits with the existing structure of BREEAM credits for other issues – a very pragmatic approach based on "level playing field" LCA methodology and data.

Weighted Credits – from a multi-stakeholder consultation process involving expert panels of Academics and Researchers, Materials and Product Suppliers, Government, Local Authorities, Activists and Lobbyists, Developers and Investors, Designers (Architects & Engineers). The results of this exercise were fascinating for the degree of consistency of result between different groups (with a few examples of spectacular disagreement).

6.2 LEED - US

LEED was developed and piloted from 1998 to 2000 as LEED V1 and launched as LEED V2 in March 2000. The special features of LEED which are note-worthy relate mainly to the model of development and implementation through a Green Building Council:

As a not for profit organization USGBC has been able to attract and motivate a very diverse coalition of stakeholders. USGBC has enjoyed extraordinary growth and generated tremendous enthusiasm in the US market. USGBC currently has 5,400 corporate members from a diverse coalition of stakeholders. USGBC has a local Chapter structure that promotes local networking, education, advocacy and marketing and market intelligence. USGBC also holds an annual conference that attracted over 8,000 delegates in 2004. USGBC is also an enthusiastic member of the World Green Building Council many of which are developing their own rating systems allowing extensive exchange of experience between National Councils. For example, The Australia Green Building Council have achieved spectacular growth and development of the Green Stars rating system.

LEED also comprises a modular program of workshops, a professional accreditation exam and a series of collateral publications for sale. LEED has also proved to be very adaptable to different climates across the US and this makes it also easy to adapt to other countries. LEED is licensed to Canada and India Green Building Councils and there is interest from several other countries.

6.3 CASBEE - Japan

CASBEE has been developed as 4 integrated tools through the buildings' life cycle:

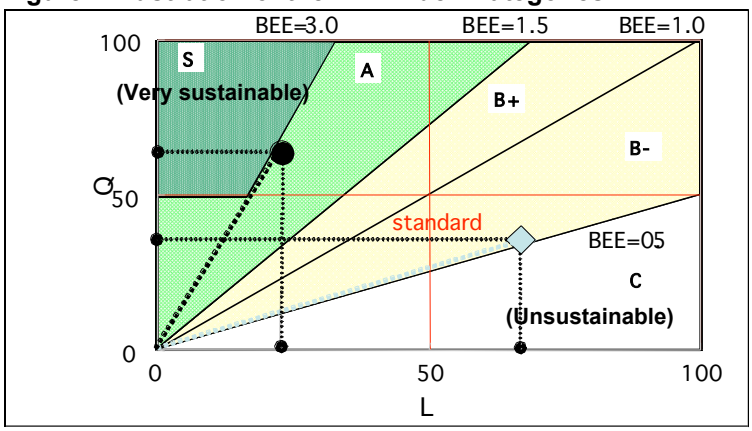
- Tool 0 – Pre-Design Tool - targeted at the owner and planner
- Tool 1 – Design Tool – a self-diagnosis software tool targeted at the designers – architects and engineers
- Tool 2 – a third party environmental labeling tool – although this is not fully implemented by a labeling body
- Tool 3 - Sustainable Operation and Renovation Tool – targeted at building owners and caretakers for the operation and maintenance of buildings

The special feature of CASBEE which is note-worthy is the re-categorizing the typical list of building attributes into:

- a Quality (Q) category - bringing together all of the positive attributes for more sustainable buildings – indoor environment, quality of service, outdoor environment on site
- a Loadings (L) category – bringing together all of the negative loadings from buildings – energy consumption, resources and materials consumed, off site environmental impacts

These are then expressed as a Building Environmental Efficiency index (BEE) as the ratio of Quality/Load.

Figure 7 Illustration of the BEE Index Categories



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The BEE concept is an interesting way of expressing sustainability assessment results. It permits a tradeoff between environmental loadings and quality of space provided. This concept has also been adopted in the GOBAS rating system developed in China for the upcoming Beijing Olympics.

6.4 PromisE - Finland

PromisE is currently being piloted for use within Finland. It is an environmental assessment and classification system for residential, office and retail buildings in Finland.

The special features of PromisE which are note-worthy are:

- An alternative way of expressing the results of environmental assessment where environmental efficiency is expressed as:
  - Efficiency = Property Value (Financial) / (Property Cost + Environmental Impact)
  - where all values are brought to dimensionless indices before being placed into the equation.
- Integrating the building level measure of efficiency from bottom up component/product level LCA through systems level LCA to the building environmental assessment.
- Integrating the building level assessment into corporate property portfolios (because the financial implications are inherently built into the efficiency measure.

7. Conclusions

Considerable progress has been made in recent years in the evolution of environmental assessment methods and promoting their use by the industry.

The future evolution of existing sustainability assessment methods for buildings is likely to include:

- Continuing refinement of the metrics and methods of assessment of the sustainability of buildings which is likely to include:
  - Improved methodology to provide a level playing field and publicly available data for the use of LCA in buildings
  - Improved tools to make the complexity of LCA accessible and practical for designers, operators and owners of buildings.
  - Improved performance based metrics, underpinned by better research for a broader range of sustainability measures in existing assessment and certification systems
- Steady progress in the market uptake of these methods and transformation of the building and real-estate industries.
- Steady growth in the achievements, activity, growth and influence of Green Building Councils internationally

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