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Background of CASBEE development

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Abstract Large amounts of resources and energy are consumed in the building sector. However, in response to the growing awareness of global environment problems, those in the building sector also recognized the necessity of making contributions toward the mitigation of environmental problems. The development of BREEAM was spurred by such circumstances. Its innovative scope and method attracted worldwide attention and eventually led to the global movement for developing assessment tools. Following BREEAM, other assessment tools for building environmental performance such as LEED were also developed and used around the world (BRE, 2013; USGBC, 2013), significantly contributing to the reduction of building-related environmental loads. Figure 2.1 shows the assessment tools developed worldwide.
In Japan, under the leadership of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), a committee was established inside IBEC, and in 2001, initiated the development of tools to evaluate the environmental performance of buildings. The term Comprehensive Assessment System for Built Environment Efficiency CASBEE was coined through the activities of this committee.

GLOBAL ENVIRONMENT ISSUES AS A BACKGROUND

The seminal book – "The Limit to Growth" (Meadows, *et al.,* 1972) – that presented the potential cosnsequences of human demands on the earth's resources was published by the Club of Rome in 1972. The following year's oil shock inspired Amory Lovins*, et al.* to publish "Soft Energy Paths" in 1979 and appeal to public sentiments. At the end of the 20th century, the whole concept of civilization and mass consumption started to be seriously debated, and a sense of emerging problems regarding the global environment became more tangible. With such trends, the United Nations' Brundtland Commission released "Our Common Future" in 1987 (WECD, 1987) which introduced the concept of "Sustainable Development." This notion has subsequently served as a significant paradigm for society, the economy and politics.
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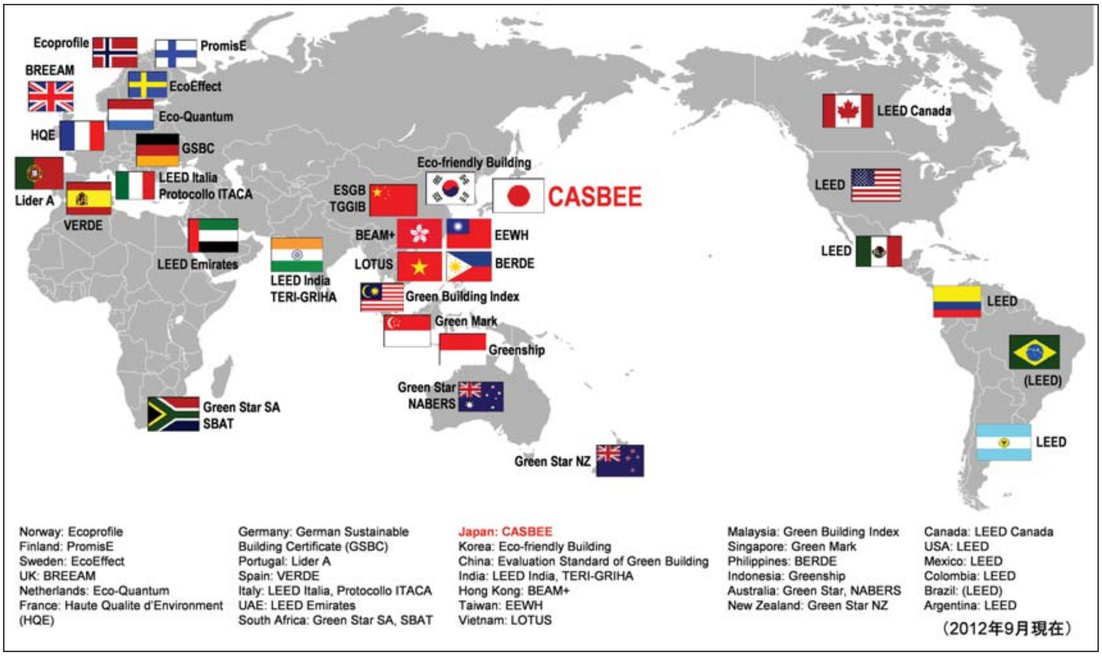
Figure 1 Assessment tools developed worldwide (as of September 2012)



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SUMMARY FROM A HISTORICAL PERSPECTIVE OF ENVIRONMENTAL ASSESSMENT AND RESEARCH IN THE BUILDING SECTOR

Three stages of environmental assessment

The environmental assessment of buildings, while seemingly a new topic, had been discussed and practiced several years before global environment problems surfaced. However, earlier environmental assessments of performance of buildings focussed on evaluating their indoor environment quality - that is to say, the environmental assessment conducted for the “amenity improvement for everyday life of building users”. This type of assessment exclusively dominated the traditional environmental assessment methods in the discipline of architectural environmental engineering, which can be regarded as the first stage of building environmental assessment. At that time, environment problems did not exist on the global scale that they do today. The environmental loads on the natural systems related to building construction and operation were hardly taken into consideration in performance assessment. Incidentally, it was in the late 1950s when the discipline called “Principles of Architectural Planning” was renamed “Environmental Control Engineering” in the University of Tokyo’s Department of Architecture, and research on indoor environmental assessment has remained a major topic in this discipline.

In the 1960s, pollution became a problem throughout Japan and other industrialized countries. In urban areas, the so-called neighborhood environment became an important social issue and an administrative procedure for evaluating the influence on the environment was widely accepted by the public as the "Environmental Impact Assessment". This can be described as the second stage of environmental assessment wherein only the negative aspects of a building against its surroundings (*i.e.*, pollution) were included for assessment as environmental influence (*i.e.*, environmental load). A typical example is acceleration of wind caused by interaction with a building. The stance at the second stage is quite explicit and is opposite to that of the first stage, because environmental loads on the outside were exclusively assessed. The administrative procedure for the assessment has stayed in effect.

The third stage is defined by the environmental assessment starting between the end of the 1980s and the early 1990s when global environmental issues became high on the international political agenda. This stage is characterized by the explicit inclusion of the health of the "Earth" as a relevant subject for the assessment. Although the reduction of "environmental loads" remained a primary issue, the aspect of amenities was also considered to improve the quality of life (QOL). Two different aspects represented by an incompatible vector (environmental load reduction and environmental quality improvement) were included for the assessment which, to some extent. resulted in less clarity than at the first or second stage.

The assessment of the third stage is currently of the primary interest worldwide and the term "environmental performance assessment," now simply means this type of environmental assessment. This book also addresses the tools for the third-stage assessment.

The word "environment" – its versatility and ambiguity

The word "environment" is quite versatile and today is used in a variety of contexts. As described in the previous section of the history of environmental studies, what are known as "living environment" and "global environment" represent entirely different dimensions of "environment" in terms of the relation to external diseconomies. The idea of environmental loads and associated problems created a broad public and political sentiment sufficient to demand a paradigm shift away from the culture of the 20th century where people were encouraged to consume more and more.

When the "**living environment**" is considered, its goal is the improvement of so-called QOL. On the other hand, the word "**global environment**" entails the demand for reduction of environmental loads. Despite their fundamentally different essence, according to conventional logic, therefore, there is frequently a trade-off between these two environments. Finding a solution to the conflict between these two is a critical challenge in the field of environmental engineering. In CASBEE, as is described later, this problem is handled by associating each assessment item with either Q (Quality: environmental quality) or L (Load: environmental load), thus separately assessing these two categories. Of numerous discussions about "environmental issues," few were carried out with a definite awareness of the difference between the two, which is a cause of confusion about how to deal with environmental issues. (Murakami, 2004)

THE IMPORTANCE AND EFFECT OF ENVIRONMENTAL ASSESSMENT TOOLS

Visualization of performance and the positioning of environmental performance assessment

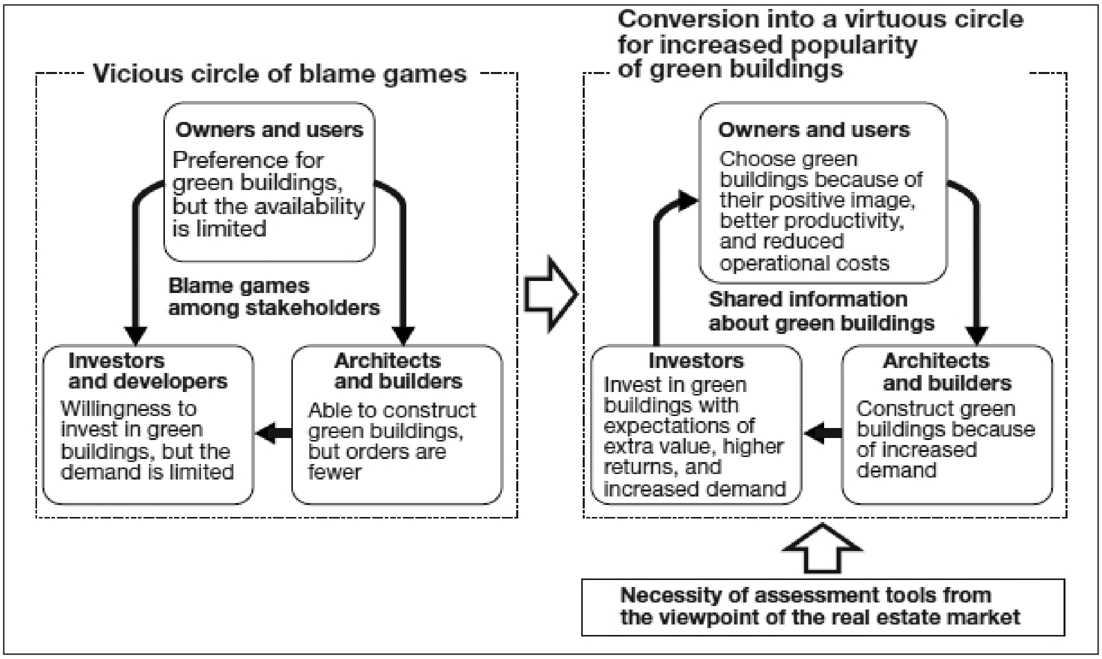
When traveling, hotel rankings displaying a number of stars such as the Michelin Guide are useful in making choices regarding where to stay. These rankings are called the visualization of performance wherein specialized information is quantified by experts in the context of quality of service in society and the results are released to the public. Having better information accessibility for the public in the form of performance visualization can make a considerable difference from the viewpoint of abatement of information asymmetry to general users who are isolated from and may struggle to understand specialized information. In addition to the rankings in the service industry initiated by Michelin, there are also ranking systems in such fields as Japanese artistic skills or martial arts (**dan** rank) or the handicaps in golf, which started in the UK. These are individual skill rankings, but the intention and effect of visualization are the same.

The building or city performance assessment tools also intend to visualize performance. This visualization is especially important, because the buildings and cities are, in themselves, social assets. The goals of developing the assessment tools include the reduction of building-induced environmental loads and the performance improvement by making the information on building performance visible and accessible to the public as global environment problems become more serious. As mentioned before, this form of contribution has been welcomed worldwide. At present, almost every country where construction is a major industrial activity has developed its own assessment tools or adopting ones that have been developed elsewhere, producing profound reduction of the environmental loads associated with the building sector.

Environmental information share and market reform through visualization

Visualized performance not only benefits users by making performance information accessible to the public, but also gives incentives for better performance to owners/designers/builders or those in local government. Following the development and increased popularity of assessment or rating tools, revolutionizing the market in construction/urban industries through such visualization is the next emerging challenge in the building sector and urban development. Publicized ranking results consequently encourages stakeholders such as building owners, designers and local governments to design and construct a city or building with superior environmental performance. This effect is the linchpin for market reform. Figure 2 shows the reformed market structure. It is essential to collect the data on green buildings assessed by the tools in order to demonstrate the benefits of buildings with superior environmental performance and thereby, increase the number of construction orders or investment opportunities and creating an excellent selection of high-quality buildings in the market.

Figure 2 Reforming the real estate market to gain wider popularity for green buildings and the role of assessment tools (RICS, 2008)



The importance of market reform through visualization lies in the performance being improved by publicly available information and the subsequent autonomous decisions, not solely by the enforcement of the laws. Such movement of the market change resulting from performance assessment has already surfaced in Japan and North America and is gaining momentum across the world. Significant contributions toward the reduction of global environmental loads are being realized in the building sector and urban development.

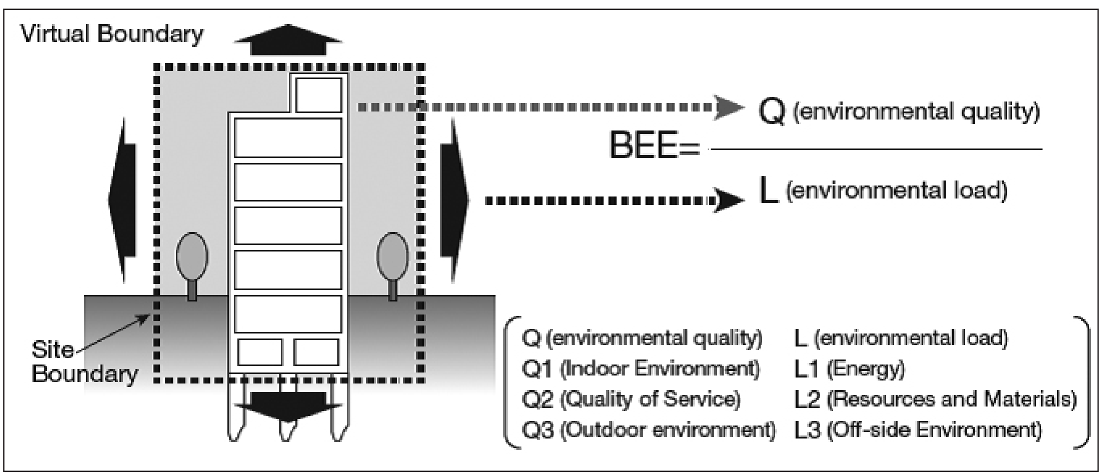
THE FEATURES OF THE ASSESSMENT TOOL SYSTEM AND METHODS

Compared to other tools available worldwide, CASBEE exhibits a unique and simple structure. The key characteristics of CASBEE are as follows:

Clear definition of spatial boundaries to be assessed

In many tools in use worldwide, the subject of assessment is often vaguely defined as a building or a location. However, the clear definition of spatial zones to be assessed should never be omitted before conducting an assessment. In this regard, of the assessment tools available throughout the world, only CASBEE is explicit on this issue. In CASBEE, the virtual boundary is introduced as an area surrounding the building concerned and is treated as a site boundary. The inside and the outside of the virtual space boundary are specifically framed to be evaluated separately. The key here is that the surrounding area of the building is explicitly included for the on-site assessment. (Murakami, 2004) This concept is illustrated in Figure 3.

Figure 3 Setting of the spatial boundary for CASBEE assessment and the definition of Built Environment Efficiency (BEE)



With the exception of CASBEE, no other tools give a clear definition describing the site from the perspective of an area to be evaluated.

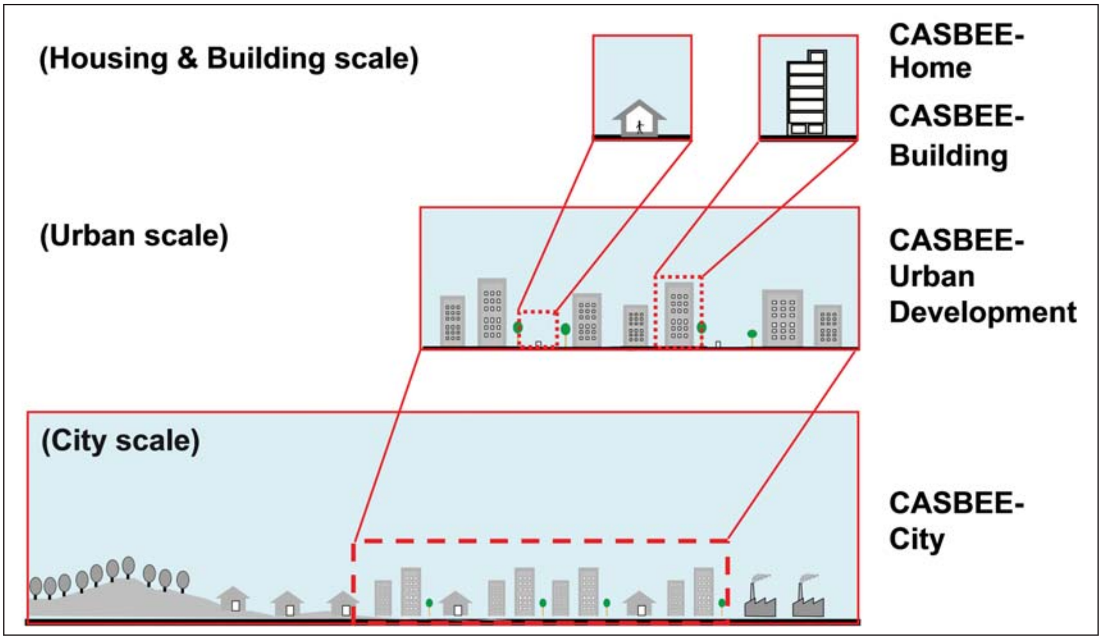
Clear definition of environments to be assessed

As already mentioned, a pair of different aspects represented by an incompatible vector, that is, improvement of Q (environmental quality) and reduction of L (environmental load) are included for building environmental assessment in this global environment era. Only the CASBEE tool system was designed with this point of view. In CASBEE, as shown in Figure 3, each item to be evaluated is first associated with either Group Q or Group L and is further assigned to the respective sub-group for more detailed categorization.

Scoring method
Many assessment tools have adopted the simple addition of scores attained from the respective assessment items. However, as shown in Figure 3, the originality of the CASBEE assessment method stems from use of the aforementioned Q and L to obtain a scalar indicator determined by Q/L (referred to as the Built Environment Efficiency; BEE). The BEE is a concept akin to Factor Four proposed as the efficiency of resources use by Weizsäcker in Germany. (von Weizsäcker, *et al.,* 1998)

Stratified structure of a scale of defined areas for assessment
All the assessment tools starting from BREEAM were initially developed to assess office buildings and/or multi-unit residential buildings. The applicability of several tools such as BREEAM, LEED and CASBEE gradually expanded so as to perform the assessment on a scale of a district (or local area or neighborhood). (Cole, Brown & McKay, 2010) *CASBEE for Cities*, which was released recently, is the only tool enabling city-scale assessment. (Murakami, *et al.,* 2011)

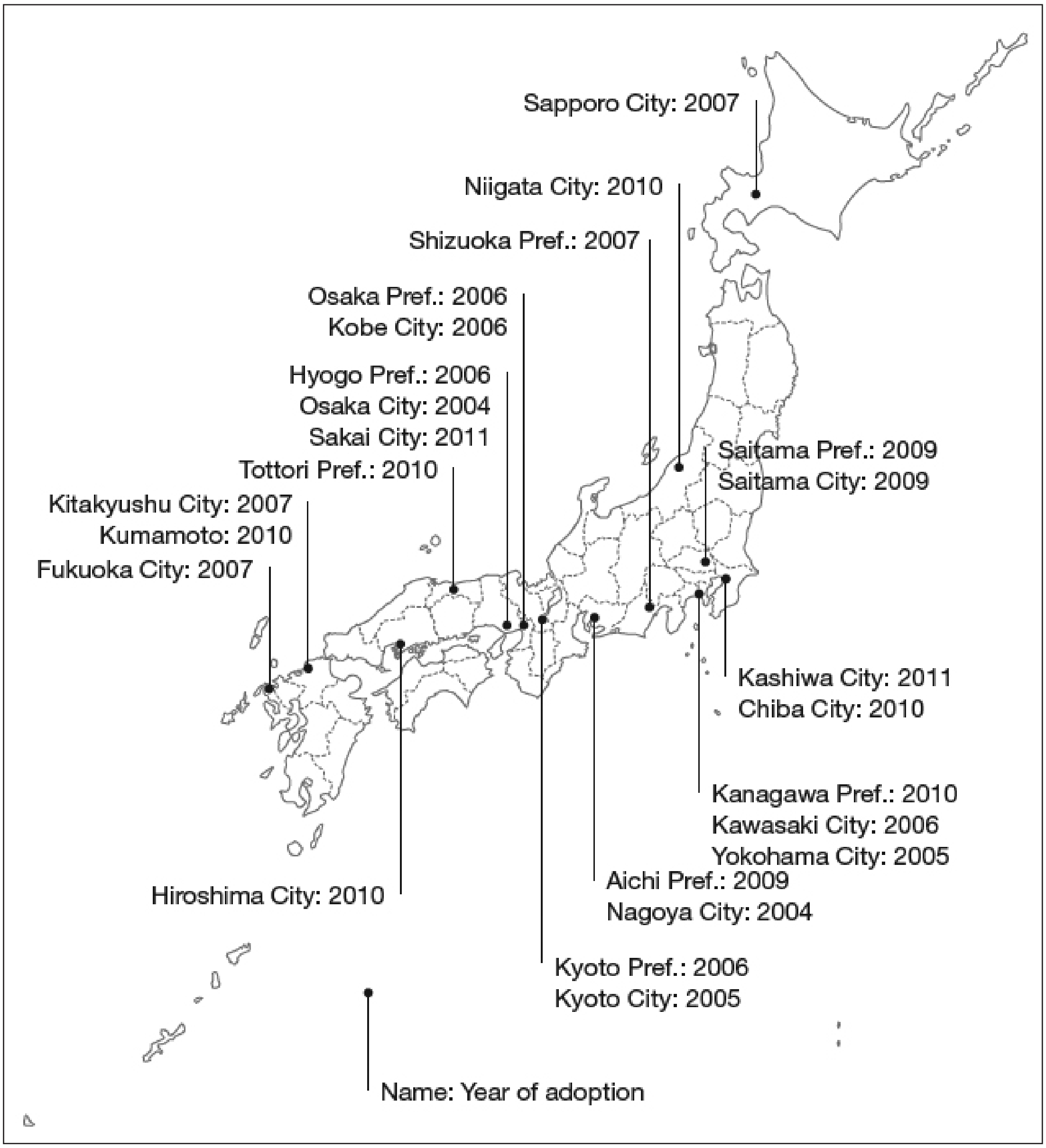
Figure 4 Stratified structure of a scale of defined areas for CASBEE assessment



Inclusion of time scale for assessment
Initially, almost all the assessment tools dealt with the new construction of buildings. The subsequent development of tools to assess the existing buildings occurred in many cases. In evaluating the existing buildings, it is not easy to collect the data necessary for the assessment. Considering the vast number of existing buildings and their often low environmental performance, the promotion of environmental assessment of existing buildings is a policy that is challenging but meaningful.

In CASBEE for Cities, urban environment can be assessed in the context of past, present and future. Urban development is usually planned and executed over a long time span. The outcomes of urban environment policy can be better presented by comparing how the city was in the past, how it is in the present, and how it would be in the future. As part of the campaign of urban environment policy, it is useful for municipal authorities to share such assessment results with their citizens. (Murakami, *et al.,* 2011)

Figure 5 CASBEE utilization by local governments for new buildings



CONCLUSIONS

Since the disaster at the Fukushima nuclear power station, the necessity of energy conservation in the building sector has become a matter of increased urgency. The environmental load produced in the building sector is so huge that it accounts for 30 to 40% of either the total consumed energy or total CO_2 emissions. Therefore, the reduction of building-induced environmental loads is one of the greatest challenges in this field. As an anticipated effective means of alleviating the current situation, the environmental performance assessment incorporated in social/administrative systems has proved appealing to the world. In Japan, as indicated in Figure 5, many local governments have made it mandatory to include the CASBEE assessment result in the application for building permits. (IBEC, 2013) This way of popularizing green buildings, in cooperation with local governments regarding the use of building assessment tools, is unique to Japan.

The experts and specialists in the building sector have a great responsibility for improving the contents or applicability of assessment tools to attain further acknowledgement of the tools, whereby more contributions toward the mitigation of global environmental problems can be made.

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