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Chapter 2

Background: Existing Japanese Systems Related to Sustainable Housing

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Abstract

In order to expand sustainable homes into the housing market, effective methods or systems for promoting sustainable housing design need to be widely disseminated in the society. In Japan, there are three important public systems related to sustainable housing design, namely the Housing Performance Indication System (HPIS), long-life quality housing (LQH) certification, and Comprehensive Assessment System for Built Environment Efficiency (CASBEE) for detached houses. The HPIS has stipulated the housing performance indication standards over 10 categories. The LQH system certifies houses that meet the criteria of long-life quality housing. CASBEE for detached houses comprehensively assesses and rates the sustainability of detached houses. However, there still remains room for further improvement in the set of these existing Japanese systems. First, the application of the systems to existing homes has been extremely limited until now. Second, CASBEE for detached houses, the one and only national comprehensive system, has not been used so often thus far. Moreover, readiness of the systems for emergent challenges, namely climate change and aging population, has also been insufficient.

Keywords: public system, Housing Performance Indication System, long-life quality housing, CASBEE

1. Introduction

In order to steadily increase the ratio of sustainable homes in the housing market, efficient systems or methods for promoting sustainable housing design need to be widely used in the society. In the world, a great number of systems related to sustainable housing have been developed and are used in many nations and regions; types of such systems include standards, guidelines, and assessment and rating systems [1]. Narrowing them down to major

Japanese public systems, this chapter first describes their main points. After that, it examines remaining issues in the set of these existing Japanese public systems.

2. Major existing Japanese systems related to sustainable housing

In Japan, there are three important public systems for improving the quality of housing and reducing environmental load from housing: (1) Housing Performance Indication System, (2) long-life quality housing certification, and (3) Comprehensive Assessment System for Built Environment Efficiency (CASBEE) for detached houses (**Table 1**). This section summarizes the main points of these public systems, including the aim of introduction and market penetration.

2.1. Housing Performance Indication System

2.1.1. Outline

In 2000, the Japanese government put the Housing Quality Assurance Act into operation. Before the enforcement of this law, there were no common rules to indicate housing performance. Accordingly, it was difficult for consumers to compare the quality of houses in the housing market. On the other hand, there was little incentive for housing producers to compete for higher performance [2]. In order to solve these problems and consistently assure the quality of houses, the Housing Quality Assurance Act has prescribed the Housing Performance Indication System (HPIS) or *Jutaku Seino Hyoji Seido* [2].

2.1.2. Indication items

The HPIS has stipulated the "Japan Housing Performance Indication Standards (JHPIS)" or *Nihon Jutaku Seino Hyoji Kijun* and the indication procedure standards [2]. Based on these standards, registered third party organizations assess housing performance and indicate its results.

The JHPIS has specified items to be indicated for homes over 10 categories [2]. The 10 categories and main items are as follows:

1. Structural stability (Resistance to earthquakes, etc.),
2. Fire safety (Fire resistance),
3. Reduction of deterioration (Measures against deterioration),
4. Consideration for maintenance (Measures for maintenance),
5. Thermal environment/energy (Thermal insulation performance or primary energy consumption),
6. Indoor air environment (Measures against formaldehyde),

7. Luminous and visual environment (Ratio of window area to floor area),
8. Acoustic environment (Sound insulation performance, etc.),
9. Consideration for the aged and others (Accessibility),
10. Security (Measures against intrusion at openings).

System name	Housing Performance Indication System	Long-life quality housing certification	CASBEE for detached houses
Essence	• Stipulation of housing performance indication standards • Assessment & indication of housing performance by registered third-party organizations	• Certification of long-life quality houses	• Comprehensive assessment of built environment efficiency • Rating and certification based on the assessment
Aim of introduction	• Enabling consumers to compare performance of houses • Builders' competition for higher performance • Assurance of housing quality	• Prolongation of housing life span • Improvement of quality of housing • Reduction of people's economic burden and environmental burden	• Promoting sustainable housing design • Measures against global environmental problems
Housing type	• New (2000-)/Existing (2002-) • Detached/Collective	• New (2009-)/Existing (2016-) • Detached/Collective	• New (2007-)/Existing (2011-) • Detached
Categories or items of indication/assessment for detached houses	• Structural stability • Fire safety • Reduction of deterioration • Consideration for maintenance • Thermal environment/energy • Indoor air environment • Luminous and visual environment • Acoustic environment • Consideration for the aged and others • Security	• Measures against deterioration • Resistance to earthquakes • Measures for maintenance • Indoor temperature and energy saving • Consideration for landscape • Total floor area • Planning for future checking & maintenance	• Comfortable, healthy & safe indoor environment • Durability for long-term use • Consideration for landscape and ecosystem • Energy and water saving • Conservation of resources and reduction of waste • Consideration for the global, local and surrounding environment
Incentives for system users		• Tax reduction (Income tax, real estate tax, etc.) • Support in taking housing mortgages	
Market penetration: Accumulated number of houses with indication/certification	[New detached houses]: 927,216 (2000–2014) [Exist. detached houses]: 1004 (2002–2012)	[New detached houses]: 576,068 (2009–2014)	[New detached houses]: 120 (2008–2016)

Table 1. Main points of the Housing Performance Indication System, long-life quality housing certification, and CASBEE for detached houses.

In 2015, the classification of the items into mandatory and optional items was revised. As a result, the number of the optional items has sharply increased. At present, all the items in the six categories, fire safety, indoor air environment, luminous and visual environment, acoustic environment, consideration for the aged and others, and security, are optional [3].

2.1.3. Market penetration

At the beginning of the adoption of the HPIS, the objects of assessment were limited to only new homes. In 2002, the HPIS was amended, so as to extend its coverage to existing homes [2].

After the start of the HPIS in 2000, the annual penetration rate into the new housing market steadily increased and reached 20% in 2006. After that, the annual penetration rate fluctuated between 19 and 24% [4]. According to the newest statistical data, in 2014, the total number of officially assessed new homes amounted to 196,021, which is equivalent to 22.3% of the total housing starts. The breakdown of these is as follows: (1) detached houses: 88,312 houses, 21.6% and (2) collective houses: 107,709 houses, 22.9% [4].

Meanwhile, this system has rarely been utilized on existing houses. As of the end of fiscal 2012, the cumulative total number of the officially assessed existing homes has been only 3433. The breakdown of this is 1004 detached houses and 2429 collective houses [5].

2.2. Long-life quality housing certification

2.2.1. Outline

In Japan, the life span of houses has been short, as compared to those in Europe and the United States. The average elapsed period of Japanese houses from the construction to the demolition is only about 30 years. Frequent construction and demolition increase materials and energy consumption for construction as well as waste. Moreover, shorter life span of houses increases people's housing expenses [6]. In order to reduce such burden on the natural environment and economic burden on people as well as improve the quality of housing, in 2009, the Japanese government introduced a new housing certification system named "Long-life quality housing (LQH)," in Japanese *Choki Yuryo Jutaku* [6, 7].

For quite a while after the start of the LQH certification system, it was applied to only new homes. In 2016, the government extended its coverage to existing homes [7].

2.2.2. Certification criteria

The Ministry of Land, Infrastructure, Transport and Tourism has stipulated the criteria for the LQH certification [8]. In the case of "detached houses," the LQH certification criteria and their essence are as follows:

1. Measures against deterioration (measures for at-least-100-year continuous use of framework),
2. Resistance to earthquakes (structure with 1.25 times the strength stipulated in the building code or base-isolated structure),

3. Readiness for maintenance and replacement (measures for easy maintenance and replacement of piping and interior),
4. Indoor temperature and energy saving (sufficient thermal insulation performance),
5. Local environment (consideration for landscape),
6. Total floor area (75 m^2 or more), and
7. Maintenance plan (planning for future checking and maintenance) [8].

In the case of "collective houses," the LQH certification requires two more criteria, in addition to the above seven criteria. The two criteria are "preparedness for future change of room arrangement" and "sufficient space in common areas for improving accessibility" [8].

2.2.3. Market penetration

The LQH certification system considerably penetrates into the housing market, especially new detached houses. In 2009, the first year of the system introduction, the penetration rate into new detached houses reached 17.2% immediately. In 2010, it increased to 23.8%. After that the annual penetration rate into new detached houses fluctuates between 23 and 24%. As of the end of fiscal 2014, the total number of the certified new detached houses amounted to 576,068. On the other hand, the penetration into the collective housing market is in a sluggish state; as of the end of fiscal 2014, the total number of the certified collective housing units is only 15,939 [9].

A significant reason of rapid dissemination of LQH certification is preferential treatment to the system users. The construction costs of the LQH-certified houses are considerably expensive compared with usual houses. Therefore, aiming to promote the LQH certification, the government has granted various kinds of preferential treatment to people who acquire the LQH-certified houses [10]. Such treatment includes reduction of income tax, real estate tax, real estate acquisition tax, and registration and license tax, as well as support in taking housing mortgages through the Government Housing Loan Corporation [10]. Moreover, there is also preferential treatment to small and medium-sized homebuilders that provide the LQH-certified homes to be concrete subsidies from the government [11].

2.3. CASBEE for detached houses

2.3.1. Outline

From around 1990, various methods for promoting green or sustainable building design appeared in the world, reflecting growing awareness of seriousness of global environmental problems [12, 13]. In 1990, the BREEAM (Building Research Establishment Environmental Assessment Method) was developed in the United Kingdom, as the world's first sustainability assessment method for buildings [14]. In the U.S., the U.S. Green Building Council was founded in 1993, with a mission to promote sustainability-focused practices in the building and construction industry [15]. In 2000, the U.S. Green Building Council unveiled the green

building rating system named LEED (Leadership in Energy and Environmental Design) [15]. In the middle of this global trend, Comprehensive Assessment System for Built Environment Efficiency (CASBEE) appeared in Japan [12, 13].

CASBEE is a method for comprehensively assessing and rating the sustainability of buildings and built environment. In 2001, CASBEE was developed in committee set up in the Institute for Building Environment and Energy Conservation (IBEC) under the initiative of the Ministry of Land, Infrastructure Transport and Tourism [16]. Recently, the Japan GreenBuild Council and the Japan Sustainable Building Consortium have been continuously developing and updating the CASBEE systems. The CASBEE systems have been named according to the specific purposes, such as "for Building," "for Urban Development," "for Cities," and "for Detached Houses." In addition, "for Detached Houses" includes two versions: "CASBEE for Detached Houses (New Construction)," which was developed in 2007, and "CASBEE for Detached Houses (Existing Building)," which was added in 2011, as a version for existing detached houses [13, 17].

2.3.2. Assessment categories and items

CASBEE covers four assessment fields: (1) Energy efficiency, (2) Resource efficiency, (3) Local environment, and (4) Indoor environment, which are largely the same as the assessment fields of other major comprehensive methods such as BREEAM and LEED [13, 18]. However, in order to assess environmental performance more precisely, the above four assessment fields have been uniquely recategorized into Built Environment Quality (Q) and Built Environment Load (L) (**Figure 1**). "Q" is further divided into three subcategories: [Q1] Indoor environment, [Q2] Quality of service, and [Q3] Outdoor environment on site. Similarly, "L" is divided into [L1] Energy, [L2] Resources and materials, and [L3] Off-site environment. The quotient of "Q" divided by "L" represents building environmental performance with a single score of Built Environment Efficiency (BEE). According to the BEE score, the buildings are classified into five grades: S (Excellent), A (Very good), B+ (Good), B− (Fairly poor), and C (Poor) [13, 18].

In case of "CASBEE for Detached Houses," 21 middle-level assessment items and 54 scoring items are allotted over the total six subcategories [13]. The following shows the middle-level assessment items by each subcategory:

[Q1] Comfortable, healthy, and safe indoor environment: "Heat and cold," "Health, safety, and security," "Brightness," and "Quietness,"

[Q2] Durability for long-term use: "Basic performance for the duration of long-term use," "Maintenance and management," and "Service ability,"

[Q3] Consideration for the townscape and ecosystem: "Consideration for townscape and view," "Creation of biological environment," "Local safety and security," and "Utilization of local resources and preservation of the architectural/dwelling cultural heritage,"

[L1] Energy and water conservation: "Energy conservation by means of improvements to the house," "Energy conservation by means of improvements to facilities," "Water conservation," and "Improvements to the maintenance, management and operation system,"

[L2] Conservation of resources and reduction of waste: "Use of resource-saving materials and less waste-producing materials," "Waste reduction at the production/construction stages," and "Recyclability," and,

[L3] Consideration for the global, local and surrounding environment: "Consideration for the global environment," "Consideration for the local environment," and "Consideration for the surrounding environment" [13].

2.3.3. Market penetration

According to the organizer of CASBEE, CASBEE is broadly used by many construction companies, design offices, real-estate developers, etc. as a voluntary-basis evaluation tool for checking the environmental performance of their buildings [19]. However, statistical and survey data indicate that CASBEE is not so widespread, especially among smaller companies.

The number of the CASBEE certification is extremely limited, as compared with other major assessment and certification systems, such as BREEAM and LEED. As of March 2017, the total number of the CASBEE-certified buildings/projects is approximately 600, which includes 120 of the "CASBEE for Detached Houses" certified homes. All of the CASBEE-certified homes are new homes; the number of the certified existing homes is still zero [19, 20].

On the other hand, the number of BREEAM and LEED certification is larger than that of CASBEE certification by orders of magnitude. According to the home page of BREEAM, globally there are more than 559,900 BREEAM-certified developments, and almost 2,262,100 buildings registered for assessment, since it was launched [14]. Similarly, "USGBC Statistics" shows that there are more than 36,400 certified commercial projects and more than 121,400 certified LEED for Homes residential units, as of January 2017 [21].

Meanwhile, a questionnaire to home builders suggests that CASBEE for detached houses is not used so often, or not even known so much, especially by smaller organizations. According to the analysis based on 252 valid survey responses from Japanese housing construction companies, about half of the respondents answered that they were unaware of CASBEE [22]. More specifically, "51.6%" of the respondents reported that they "had never heard of" CASBEE for detached houses, while "34.1%" of respondents answered that they "had heard of it but had never used" it, and "14.3%" of respondents reported that they "had used" it. In addition, the

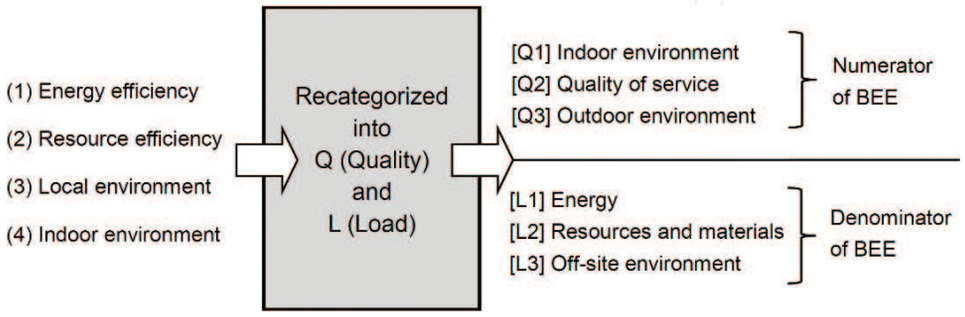

Figure 1. The core concept of CASBEE [13].

ratio of answering "Never heard of" was higher among the respondents from smaller sized housing companies; the ratio of reporting "Used" was higher among the respondents from larger sized companies [22].

3. Remaining issues in the existing Japanese systems

As described in the last section, the three public systems, namely the HPIS, LQH certification, and CASBEE for detached houses, have been developed and are used in Japan. However, there remain issues in the dissemination of these systems as well as readiness for emergent challenges, such as climate change and aging population. This section examines these remaining issues from three perspectives: (1) application to new and existing homes, (2) issue of CASBEE dissemination, and (3) readiness for emergent challenges.

3.1. Application to new and existing homes

As shown in the market penetration data, the HPIS and LQH certification have considerably penetrated into the new housing market. The penetration rates into new detached houses rapidly increased and reached 20-plus percent. However, after that the penetration rates seem to have hit a ceiling at this level. From now on, it is necessary to provide momentum for further rises in the penetration rates.

Meanwhile, the applications of the systems to existing homes have been extremely limited thus far. The HPIS has rarely been utilized on existing houses, and the LQH certification of existing houses has just started. It is obvious that these systems need to be disseminated into massive amounts of the existing housing stock.

3.2. Issue of CASBEE dissemination

CASBEE for detached houses is the only national comprehensive method for sustainable housing design. However, it has not been used so often, and the number of the certification is extremely limited. There appears to be two main reasons why CASBEE does not become widespread, that is to say, "complexity" and "shortage of incentive to obtain certification."

CASBEE is described as elaborate and hard to understand, whereas LEED is reputed as simple and easy to understand [23]. A significant cause of CASBEE's complexity is its unique core concept. As already shown in **Figure 1**, the original four categories have been recategorized into "Q" and "L." This recategorization has inevitably made the system complex and difficult to understand.

The second reason is shortage of incentive to obtain CASBEE certification, as compared with LEED. In the U.S., many states and local governments have adopted various types of direct incentives for "green buildings," including LEED-certified buildings. Examples of such incentives are tax credits, revolving loan funds, and expedited review/permitting processes [24, 25]. In addition, in the LEED system, only buildings with considerably

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high environmental performance can be certified (**Figure 2**, left); therefore, LEED-certified buildings are naturally recognized as green buildings [23]. Furthermore, in the areas where LEED is widespread, there has been building a consensus that green buildings have competitive superiority in the real estate market. In other words, people in such areas have been sharing information on studies which show that certified green buildings outperform over traditional buildings in asset value, rent, and occupancy rate [26–28]. In this way, there are also social incentives to obtain a LEED certification, in addition to the direct incentives.

On the other hand, there is little incentive to obtain CASBEE certification. Originally, CASBEE systems certify all the assessed buildings and rate them into five ranks: S, A, B+, B-, and C. Accordingly, as shown in the right of **Figure 2**, CASBEE-certified buildings do not necessarily mean green buildings. In addition, governments hardly offer direct incentives, such as tax credits, to developers or owners of grade "S" or "A" certified buildings. Moreover, there has also been little shared understanding that green buildings have competitive advantage in the real estate market of Japan thus far [29].

3.3. Readiness for emergent challenges

As "climate change" becomes aggravated, houses need to take further mitigation measures as well as adaptation measures. The LQH certification requires higher thermal insulation performance of the housing envelope, which is significant as both mitigation and adaptation measures. However, it refers to neither equipment for harnessing renewable energy nor energy efficiency of apparatus such as water heaters. CASBEE for detached houses refers to all of these items, but there is a problem which the system itself has not been

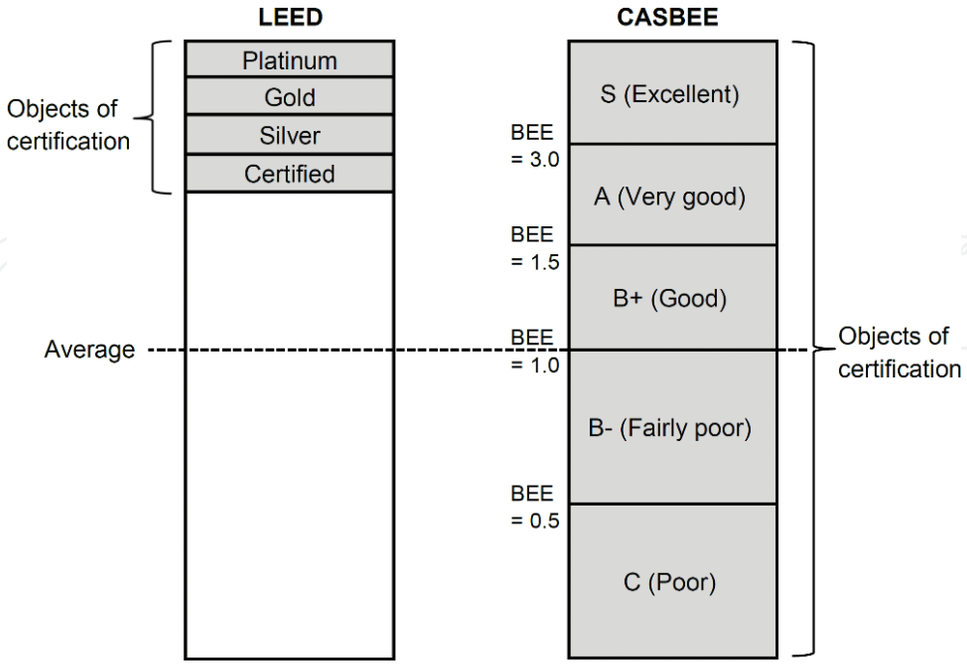

Figure 2. Rating and certification of LEED and CASBEE.

used so often until now. Meanwhile, none of the three existing systems have included any descriptions of strengthening adaptation measures thus far.

On the other hand, readiness for "aging population" in the housing systems has been sluggish, although Japan is the fastest aging country in the world. The LQH certification requires detached houses to take neither accessibility nor universal design. The HPIS includes "Consideration for aged and others," which refers to accessibility, as one of the categories to be indicated. However, in 2015, "Consideration for aged and others" changed from a mandatory category to be indicated to an optional one. Such a system amendment even appears to be against the time.

4. Necessity of more efficient systems for promoting sustainable design

From around 2000, public systems for improving housing performance were developed and have been used in Japan. Especially the three systems, namely the HPIS, LQH certification, and CASBEE detached houses, occupy an important position in the Japanese housing policy. The HPIS has stipulated standards for assessing housing performance. The LQH system certifies houses which meet the criteria of long-life quality housing. CASBEE for detached houses comprehensively assesses and rates the sustainability of detached houses.

However, there still remain issues in the set of these existing systems. First, the application of the systems to existing homes has been extremely limited until now. Second, CASBEE for detached houses, the one and only national comprehensive system, has not penetrated much into the housing industry, especially among smaller companies, thus far. Moreover, readiness of the systems for the emergent challenges is insufficient. In particular, taking up accessibility and universal design into detached houses has been sluggish, although Japan is the world's fastest progressing aging country. It is obvious that the set of the existing Japanese public housing systems need to be improved toward more efficient one.

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