CASBEE® for Home (Detached House)

Comprehensive Assessment System for Building Environmental Efficiency

● Technical Manual 2007 Edition

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Tool-11

Institute for Building Environment and Energy Conservation (IBEC)

Introduction

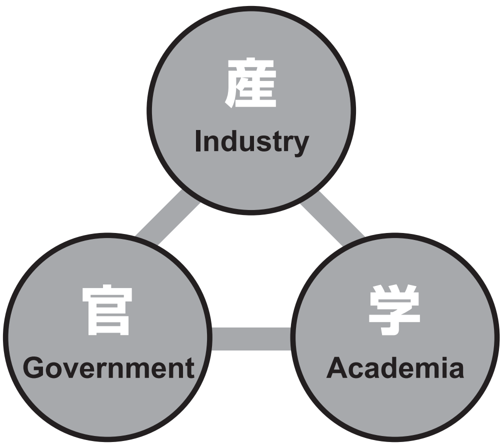
Promotion of sustainability is one of the great challenges facing humankind. Since the building industry started to move toward the promotion of sustainable building in the latter half of the 1980s, various techniques to evaluate the environmental performance of buildings have been developed, including BREEAM (Building Research Establishment Environmental Assessment Method) in the United Kingdom, LEED™ (Leadership in Energy and Environment Design) in the United States, and the international GB Tool (Green Building Tool). Architectural sustainability is now attracting a great deal of attention.

In Japan, a joint industrial/government/academic project was initiated with the support of the Housing Bureau, Ministry of Land, Infrastructure and Transport (MLIT), in April 2001, which led to the establishment of a new organization, the Japan Sustainable Building Consortium (JSBC), with its secretariat administered by the Institute for Building Environment and Energy Conservation. JSBC and a subcommittee under it are together working on R&D of the Comprehensive Assessment System for Building Environmental Efficiency (CASBEE). CASBEE is a building assessment system unique to Japan for its introduction of an innovative concept: it evaluates a building from the two viewpoints of environmental quality and performance (Q = quality) and environmental load on the external environment (L = load) when evaluating the environmental performance of the building and defines a new comprehensive assessment index, the Building Environmental Efficiency (BEE), by Q/L. Today, the enhancement and diffusion of CASBEE are being promoted under the MLIT Environmental Action Plan (June 2004) and the Kyoto Protocol Target Achievement Plan (approved by the Cabinet on April 28, 2005).

Some 500,000 independent houses are newly constructed every year, and it is said that the energy consumed by this detached housing stock throughout Japan accounts for about half the energy consumed by all residential units. The promotion of environmental measures targeted at these detached houses will help to greatly improve the environmental performance of residential life in the entire country. The major development target of CASBEE for Home (Detached House) is to disseminate such high-quality housing stock throughout Japan.

We hope that CASBEE for Home (Detached House) will be widely utilized and make a major contribution to the promotion of sustainable building in Japan.

Shuzo Murakami, Chairman
Japan GreenBuild Council (JaGBC) / Japan Sustainable Building Consortium (JSBC)



Promotion of CASBEE for Home (Detached House)

Shuzo Murakami, Keio University

1 Individual and Social Aspects of Housing

Housing has two characteristics; namely, the individual aspect and the social aspect. The former refers to the ownership or use of a house by an individual that provides a decent basis for the individual's life, while the latter refers to the house's contribution to the formation of the local environment as one of the constituents of society, and its inheritance through the generations as a social asset. For example, a house owned by an individual is legally required to be earthquake-resistant despite its personal nature. This is a good example of the social aspect of housing.

A new problem has emerged concerning the design, construction, and use of housing. This is the problem of the global environment. A large amount of resources is consumed when a house is constructed. A house also consumes a large amount of energy when used after its construction. We must therefore study the performance of houses during the design and construction stages and build houses that are of high quality and have a lower environmental load. This is our obligation as people living in this era of the global environment. CASBEE for Home (Detached House) was developed in response to these circumstances.

2 Benefits Obtained from CASBEE Assessment

"What are the advantages for us if we evaluate a house by CASBEE?" This is one of the questions we are often asked. The answer to this is that you can obtain both individual benefits and social benefits.

Let me explain the social benefits first. CASBEE evaluates environmental load from various viewpoints. Now that serious discussions are going on about the future of humankind, which is threatened by advancing global warming, those who build houses are obligated to try to reduce their environmental load. The use of CASBEE to evaluate housing is a very effective means of doing so. If many people use CASBEE for evaluation of their housing, it will enable society as a whole to greatly reduce the burden on the global environment.

CASBEE also assesses the environmental quality of housing from various standpoints, which serves to improve its performance. Housing builders are obliged to construct good houses, maintain them as a social asset, and hand them down to their descendants.

Next, let's look at the individual benefits.

If a house is evaluated by CASBEE during its design stage, its objective and specific performance related to environmental quality or load will be revealed. The results will improve the design plan. In other words, CASBEE serves as a communication tool between the ordering party and the architect, and also as a design support tool.

If a house is evaluated by CASBEE after completion of its design, it will be automatically rated based on the evaluation results, and the house owner will therefore be able to understand the quality and environmental load of his or her own house. Eventually, the owner will be able to learn where his or her house stands among many other houses in terms of environmental performance. This, in turn, will assist housing owners in developing their lifestyle plans after occupation of their residence.

Evaluation of your house by CASBEE will also improve its asset value. This is because the real estate market will value houses whose performance is clearly revealed more highly than those whose performance is not.

As described above, evaluation by CASBEE brings about both social and individual benefits. What is important is to construct houses that become good social assets and hand them down to posterity. Evaluation and rating of the performance of houses, publication of the evaluation results, and their dissemination in society will be of great assistance in realizing this purpose. Publication of this information will give the whole of society an incentive to further promote energy saving. As a consequence, accumulation of the evaluation results of CASBEE will undoubtedly be a great social asset.

3 Obligation of Citizens to Foster Housing Development as a Social Asset and Utilization of CASBEE

The construction of houses that serve as good social assets is an obligation of all citizens. Various measures have already been implemented to fulfill this responsibility. One representative measure is the enactment of the

Building Standards Act. This act stipulates earthquake-resistance standards for housing units in the case of an earthquake disaster and ventilation performance standards with respect to sick building syndrome. It is a legal obligation to comply with these performance standards; that is to say, all citizens must observe them when they build a house.

The use of CASBEE is voluntary by nature. But many local governments have recently decided to require the use of CASBEE for evaluation as part of the building permit application procedure when the building to be constructed is large in scale. This can be considered to be a clear expression of the strong conviction of administrative authorities and citizens alike that owners or builders of large-scale buildings must take the initiative in reducing their impact on the global environment and in facilitating the accumulation of good building assets. As global environmental problems are now becoming more serious, we believe that it is time to move to the next step where all buildings, regardless of size and including residential housing, are evaluated by CASBEE to help reduce their environmental impact.

CASBEE for Home (Detached House) is here to stay.

Contents

Part I

What is CASBEE for Home (Detached House) ?

1 Outline of CASBEE for Home (Detached House)

1.1 What is CASBEE?

CASBEE (the Comprehensive Assessment System for Building Environmental Efficiency) is a system for evaluating and ranking buildings in terms of their environmental performance. CASBEE was developed by a committee set up in the Institute for Building Environment and Energy Conservation (IBEC) under the initiative of the Ministry of Land, Infrastructure and Transport (MLIT) in 2001. Since 2002, a series comprising various categories of CASBEE has been sequentially developed including CASBEE for New Construction, CASBEE for Existing Building, CASBEE for Renovation, and CASBEE for HI (Heat Island) as office building evaluation systems, as well as CASBEE for Urban Development as a building evaluation system. As part of this series, we decided to develop CASBEE for Home (Detached House).

Other countries, particularly in Europe and North America, are also promoting such environmental performance assessment systems, including BREEAM and Eco-Homes in the United Kingdom and LEED in the United States. Japan is disseminating CASBEE in line with this movement.

1.2 Objective of CASBEE for Home (Detached House)

Detached houses account for about half of all housing units in Japan. Some 500,000 houses are constructed every year. If these residences provide a good living environment, can be used for a long time, and are designed to save energy and resources, this will greatly reduce the environmental load and improve the quality of living in the entire country. The major objective of CASBEE for Home (Detached House) is to increase such superior housing stock throughout Japan.

1.3 What is Evaluated

CASBEE for Home (Detached House) evaluates the general environmental performance of detached houses from two viewpoints: the environmental quality of the house itself (symbolized by "Q" for quality) and the environmental load imposed by the house on the external environment (symbolized by "L" for load). Q and L each have three assessment categories, and specific efforts are evaluated under each of these categories.

Evaluation of the level of environmental quality (Q)

- Q1 Comfortable, Healthy and Safe Indoor Environment
- Q2 Ensuring a Long Service Life
- Q3 Creating a Richer Townscape and Ecosystem

Evaluation of efforts to reduce the environmental load (L) by load reduction (LR)

- LR1 Conserving Energy and Water
- LR2 Using Resources Sparingly and Reducing Waste
- LR3 Consideration of the Global, Local, and Surrounding Environment

Hence, the type of house that will receive a high score in the CASBEE for Home (Detached House) evaluation is one that is comfortable, healthy, and safe (Q1), can be used for a long time (Q2), conserves energy and water (LR1), incorporates efforts to reduce the environmental load including efforts to minimize waste during construction and dismantling (LR2), and contributes to the formation of a better environment (Q3, LR3).

1.4 Basic Philosophy of Assessment

CASBEE for Home (Detached House) makes a comprehensive assessment of the environment-related performance of detached houses. It will therefore give a higher score to a house constructed so that various factors in relevant fields are well balanced in its design than to a house designed for a specific purpose. In no way does it reject efforts focused on a specific aspect, but greater emphasis is placed on raising the basic level of efforts in the entire environmental field; specialization can come later.

CASBEE for Home (Detached House) covers not only the building itself but also the external area, the equipment brought in by the occupants, the provision of information from the building suppliers to the occupants, and actions taken during the member production stage and at the construction site. These include items that building suppliers find it difficult to be directly involved in, but that have been selected as items to be assessed based on the judgment that they have an appreciable effect on the environment.

1.5 Points to Note about Publication of Assessment Results

CASBEE for Home (Detached House) can evaluate a house based on assumed conditions even though the house is at a stage in which not all of the assessment conditions have been established, such as at the initial design stage. It is logical that the final results of the assessment may turn out to be different from such tentative results. Therefore, it is important to provide accurate information on at what stage or under what conditions the house was evaluated in addition to the assessment results when the results are presented to a third party. It is also important for the parties that receive the results to fully understand these points. For details, see Part I, 3.3, "Rules for Presentation of Assessment Results."

1.6 Future Schedule

Since CASBEE for Home (Detached House) was developed primarily for the purpose of evaluating newly built detached houses, it may not be appropriate for other types of residences such as existing houses or duplex houses. As part of our ongoing efforts to establish the full series of CASBEE for Home, we are studying the development of an additional version of CASBEE for Home that takes these points, as well as collective housing, into consideration.

We also plan to refine the CASBEE Accredited Professional Registration System* already put in place for the existing CASBEE series. In view of the fact that CASBEE for Home (Detached House) is for the assessment of detached houses, we plan to set up a system that covers second-class architects and wooden-housing architects in addition to first-class architects.

* CASBEE Accredited Professional Registration System

Although CASBEE is aimed at making assessments that are as quantitative as possible, some assessment items are qualitative by nature. Specialists are therefore required who have the knowledge and techniques necessary for the comprehensive environmental performance assessment of buildings. The CASBEE Accredited Professional Registration System was developed and introduced with this as a background. The system is currently operated by IBEC.

2 Assessment of CASBEE for Home (Detached House)

2.1 Basic Structure of Assessment

① Scoring by the item

As explained in the preceding section, CASBEE for Home (Detached House) assesses the comprehensive environmental performance of detached houses from two viewpoints: environmental quality (Q) and environmental load (L). Each of Q and L has three assessment categories ("major items"), each of which in turn is subdivided into one to three stages ("medium-level item," "minor item," and "detailed item," respectively). A total of 54 assessment items allocated to these categories are evaluated by a scoring policy that assigns a maximum of five points down to one point, called scoring items. Each result is summed up for each subdivision to identify which efforts in which category are excellent or poor. Examples of the results provided by the dedicated software are shown in Figs. 1.1 and 1.2 (See Part II, 2., "Assessment Method," for descriptions of how to use the software and read the results).

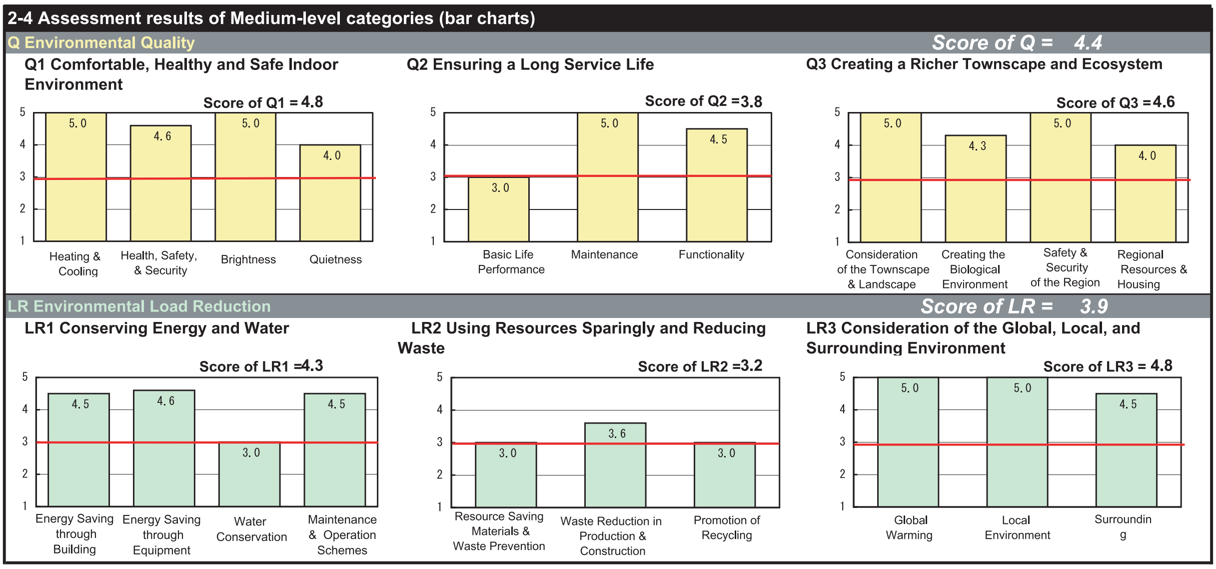


Fig. 1.1 Example of comparison of scoring results by medium-level items (window displayed by the software)

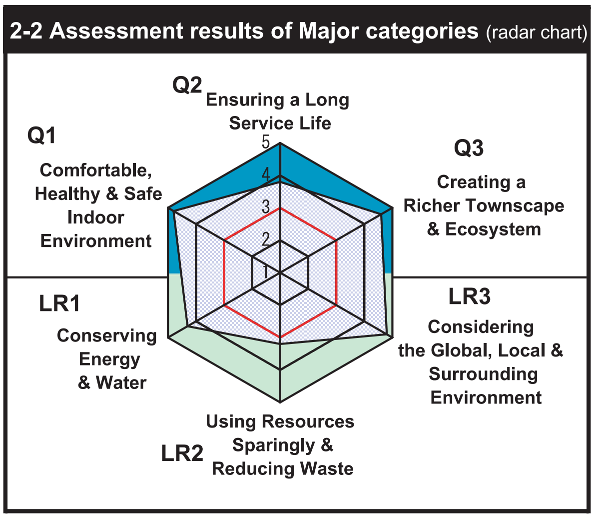


Fig. 1.2 Example of comparison of scoring results by major items (window displayed by the software)

② Calculation of Building Environmental Efficiency (BEE)

The scoring results are further summed up for each of Q and L, and the summation results are finally converted to points in the range of 1 to 100. CASBEE is designed so that a house that has a higher Q (number of points scored in Q) and a lower L (number of points scored in L) will receive a better evaluation. This relationship is evaluated by means of the following index of environmental efficiency (BEE value):

Index of environmental efficiency in CASBEE for Home (Detached House):

$$BEE = Q_H/L_H$$

* The affix "H" attached to "BEE", "Q", and "L" is an abbreviation for "Home" and indicates the assessment results of the CASBEE for Home series.

BEE_H:	Building Environmental Efficiency
Q_H:	Building Environmental Quality
L_H:	Building Environmental Load

The scope of evaluation for the assessment of Q_H and L_H is defined as shown in Fig. 1.3.

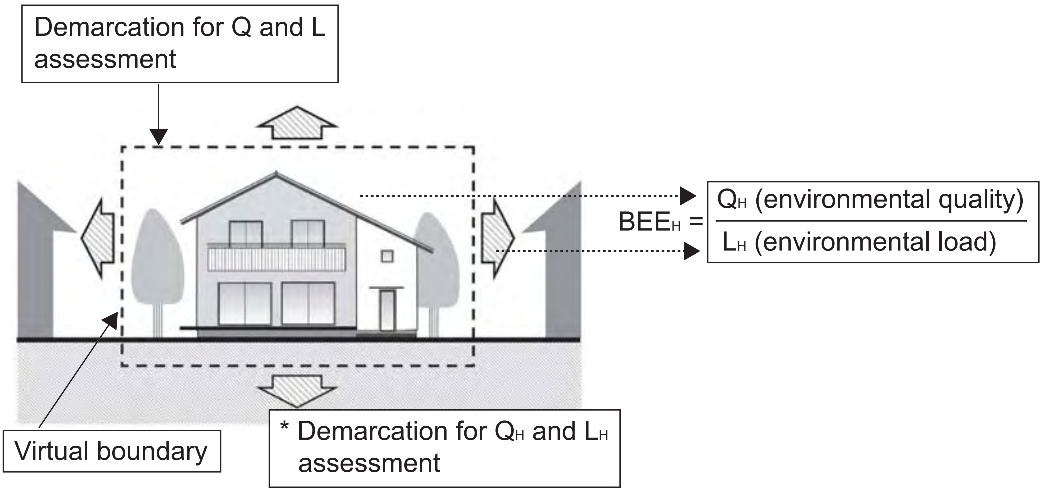


Fig. 1.3 Scope of evaluation for Q_H and L_H

The BEE value thus calculated is expressed as a point on a straight line passing the reference point in a coordinate axis with a slope of Q_H/L_H when Q_H and L_H are plotted on the vertical axis and horizontal axis, respectively (Fig. 1.4 shows an example where BEE_H = 87/23 = 3.7).

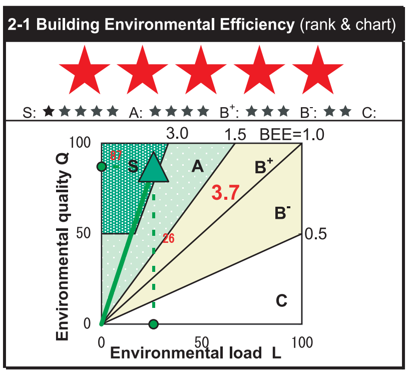


Fig. 1.4 Example of ranking based on BEE_H

③ Ranking based on BEE value

Detached houses are assessed in five ranks according to the BEE value: S, A, B+, B-, and C. Each rank is expressed by the dedicated software in terms of a number of star symbols for quicker understanding, corresponding to the descriptions of the assessments listed in Table 1.1. Although each rank is basically determined by the slope of the BEE value, a preliminary judgment line (less than 50 points) is established for the Q_H score in the case of the S rank alone. Figure 1.4 shows BEE_H = 3.7, which means that the rank is S.

Table 1.1 Correspondence between assessment and BEE value-based ranking

Rank	Assessment	BEE value	Ranking in number of stars
S	Excellent	BEE_H = 3.0 or higher	★★★★★
A	Very good	BEE_H = 1.5 or higher but less than 3.0	★★★★
B+	Good	BEE_H = 1.0 or higher but less than 1.5	★★★
B-	Fairly poor	BEE_H = 0.5 or higher but less than 1.0	★★
C	Poor	BEE_H = less than 0.5	★

One of the characteristics of assessment based on the BEE value is the correlation between the environmental quality (Q) and environmental load (L) integrated in the assessment scheme. In other words, if Q is doubled and L is halved, the BEE value will be quadrupled.

For example, assuming that the environmental load is reduced by reducing heating or cooling energy, if this means that the occupants have to withstand cold or hot temperatures, it will represent a decrease in environmental quality. A good assessment will not then be achieved. On the other hand, if energy consumption is successfully reduced without reducing the level of comfort, or the level of comfort is increased without increasing energy consumption, a higher evaluation will be given. Achieving both a reduction in energy consumption and an improvement in the level of comfort will result in the highest evaluation. This is how assessment based on the BEE ratings works.

④ Calculation of life cycle CO_2

In addition to the BEE_H value, CASBEE for Home (Detached House) allows the life cycle CO_2 emissions to be calculated as the performance of a house for global warming prevention when the assessment items are scored. This function is designed to calculate life cycle CO_2 emissions based on the scoring results related to the service life or energy-saving features of the house. The result is shown, as a guideline, in the form of a ratio to the level of CO_2 emissions of an ordinary detached house.

⑤ Scoring criteria

As described in ② above, CASBEE scores Q_H and L_H separately and uses the results of these scores to assess the BEE_H value of the house as an index. In this characteristic process, L_H is first assessed as LR_H (load reduction). This is because of the evaluation policy that it is easier to understand the scoring results of the assessment system if a higher evaluation is given to "improving both Q_H and LR_H" as opposed to "improving Q_H and reducing L_H." Based on this concept, assessment items that constitute Q_H and LR_H are each evaluated on a scale of 1 to 5 depending on the level of effort, and an assessed house that achieves higher levels is given a higher score (there are items where the levels are divided into two, three, or four).

The scoring criteria are described below.

- Levels were set so that a typical detached house as currently constructed in Japan will be evaluated as Level 3.
- There are, however, particular efforts or actions for which a judgment has been made that their diffusion will be promoted in the future, and even though their implementation will require more than the standard efforts at present, achievement of some of these efforts or actions has been set at Level 3.
- If meeting the provisions of the Building Standards Act is in the scoring criteria, this compliance line was set to the lowest level in the selectable range (that is, if the range of Levels 2 to 5 is the selectable range for scoring, Level 2 is the lowest score). It was decided not to set any level below that because any subject building failing to achieve the lowest level would be in violation of the Act.
- Likewise, for the Japan Housing Performance Indication Standards, the scoring levels were allocated to the grades so that a typical detached house is evaluated as Level 3.

Therefore, a typical house is assigned Level 3 for almost all of its assessment items and a value of approximately 1 for its BEE_H. Given this policy, any rise in the average level of Japanese detached houses in the future will require stricter CASBEE assessment criteria.

Note: In the case of efforts or actions for which a judgment has been made that their diffusion will be promoted in the future, some were set to Level 3 although they are not efforts or actions generally implemented at the present time.

After determining the assessment levels up to the acquisition of BEE_H, calculations can be easily performed by the assessment software. Figure 1.5 shows an example of a window displaying the results of assessment by the software.

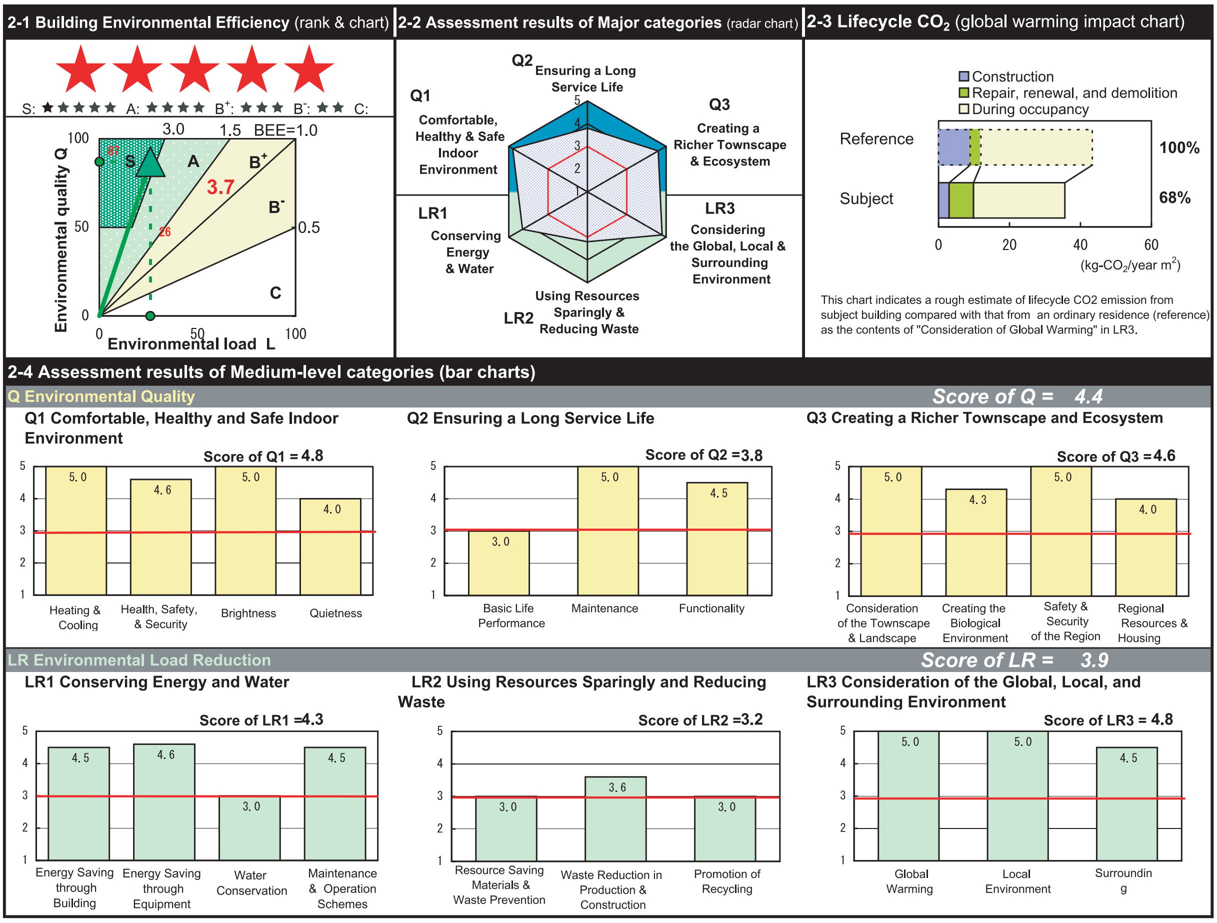


Fig. 1.5 Example of window displaying results of assessment by the software

2.2 Assessment Items

Q_H and LR_H are each composed of three major items.

Q_H1 deals with judgments related to "making the indoor environment comfortable, healthy, and safe," and assesses "heating and cooling," "health, safety, and security," "brightness," and "quietness."

Q_H2 deals with judgments related to "ensuring a long service life," and assesses "basic life performance," "maintenance," and "functionality."

Q_H3 deals with judgments related to "creating a richer townscape and ecosystem," and assesses "consideration of the cityscape and landscape," "creating the biological environment," "safety and security of the region," and "utilizing regional resources and inheriting the regional housing culture."

LR_H1 deals with judgments related to "conserving energy and water," and assesses "energy saving through building innovation," "energy saving through equipment performance," "water conservation," and "well-informed maintenance and operation schemes."

LR_H2 deals with judgments related to "using resources sparingly and reducing waste," and assesses "introduction of materials useful for resource saving and waste prevention," "reduction of waste in the production and construction stages," and "promotion of recycling."

$LR_{H}3$ deals with judgments related to "consideration of the global, local, and surrounding environment," and assesses "consideration of global warming," "consideration of the local environment," and "consideration of the surrounding environment."

The assessment items are listed below in Table 1.2.

Table 1.2 List of assessment items for CASBEE for Home (Detached House)

* Values in angle brackets <> indicate weighting coefficients. See Part I, 2.3, "Point Allocation (Weighting) Policy," for details.

$Q_{H}1$ Comfortable, Healthy and Safe Indoor Environment

Medium-level items	Minor items	Detailed items
1. Heating and Cooling <0.50>	1.1 Basic performance <0.50>	1.1.1 Ensuring thermal insulation and airtightness performance <0.65>
		1.1.2 Sunlight adjustment capability <0.35>
	1.2 Preventing summer heat <0.25>	1.2.1 Allowing breezes in and heat out <0.50>
		1.2.2 Proper planning for cooling <0.50>
	1.3 Preventing winter cold <0.25>	1.3.1 Proper planning for heating <->
2. Health, Safety, and Security <0.30>	2.1 Countermeasures against chemical contaminants <0.33>	
	2.2 Proper planning for ventilation <0.33>	
	2.3 Precautions against crime <0.33>	
3. Brightness<0.10>	3.1 Use of daylight <1.00>	
4. Quietness <0.10>		

$Q_{H}2$ Ensuring a Long Service Life

Medium-level items	Minor items	Detailed items
1. Basic Life Performance <0.50>	1.1 Building frames <0.30>	
	1.2 Exterior wall materials <0.10>	
	1.3 Roof materials/flat roof <0.10>	
	1.4 Resistance against natural disasters <0.30>	
	1.5 Fire preparedness <0.20>	1.5.1 Fire-resistant structure (excluding openings) <0.65>
		1.5.2 Early detection of fire <0.35>
2. Maintenance <0.25>	2.1 Ease of maintenance <0.65>	
	2.2 Maintenance system <0.35>	
3. Functionality <0.25>	3.1 Size and layout of rooms <0.50>	
	3.2 Barrier-free design <0.50>	

$Q_{H}3$ Creating a Richer Townscape and Ecosystem

Medium-level items	Minor items	Detailed items
1. Consideration of the Townscape and Landscape <0.30>		
2. Creating the Biological Environment <0.30>	2.1 Greening of the premises <0.65>	
	2.2 Ensuring the biological habitat <0.35>	
3. Safety and Security of the Region <0.20>		
4. Utilizing Regional Resources and Inheriting the Regional Housing Culture <0.20>		

LR_{H}1 Conserving Energy and Water		
Medium-level items	Minor items	Detailed items
1. Energy Saving through Building Innovation <0.35>	1.1 Control of thermal load of building <0.50>	
	1.2 Natural energy use <0.50>	
2. Energy Saving through Equipment Performance<0.40>	2.1 Air-conditioning systems <0.27>	2.1.1 Heating system <0.80>
		2.1.2 Cooling system <0.20>
	2.2 Hot-water equipment <0.37>	2.2.1 Hot-water supply equipment <0.80>
		2.2.2 Heat insulation of bathtub <0.10>
		2.2.3 Hot-water plumbing <0.10>
	2.3 Lighting fixtures, home electric appliances, and kitchen equipment<0.25>	
	2.4 Ventilation system <0.05>	
	2.5 Highly energy-efficient equipment <0.06>	2.5.1 Home cogeneration system <1.00>
		2.5.2 Solar power generation system
3. Water Conservation<0.15>	3.1 Water-saving systems <0.75>	
	3.2 Rainwater use <0.25>	
4. Well-Informed Maintenance and Operation Schemes <0.10>	4.1 Presentation of lifestyle advice<0.50>	
	4.2 Management and control of energy <0.50>	

LR_{H}2 Using Resources Sparingly and Reducing Waste		
Medium-level items	Minor items	Detailed items
1. Introduction of Materials Useful for Resource Saving and Waste Prevention <0.60>	1.1 Building frames <0.30>	1.1.1 Wooden house <->
		1.1.2 Steel-frame house <->
		1.1.3 Concrete house <->
	1.2 Ground-reinforcing materials, foundation work, and foundations <0.20>	
	1.3 Exterior materials <0.20>	
	1.4 Interior materials <0.20>	
	1.5 Materials for the external area <0.10>	
2. Reduction of Waste in the Production and Construction Stages <0.30>	2.1 Production stage (members for building frames) <0.33>	
	2.2 Production stage (members other than those for building frames) <0.33>	
	2.3 Construction stage <0.33>	
3. Promotion of Recycling <0.10>	3.1 Provision of information on materials used <->	

LR_{H}3 Consideration of the Global, Local, and Surrounding Environment		
Medium-level items	Minor items	Detailed items
1. Consideration of Global Warming <0.33>		
2. Consideration of the Local Environment <0.33>	2.1 Control of the burden on the local infrastructure <0.50>	
	2.2 Preservation of the existing natural environment <0.50>	
3. Consideration of the Surrounding Environment <0.33>	3.1 Reduction of noise, vibration, exhaust, and exhaust heat <0.50>	
	3.2 Improvement of the thermal environment of the surrounding area <0.50>	

The environmental performance of a house may not necessarily be evaluated in a quantitative manner. There are evaluation items in CASBEE for Home (Detached House) such as thermal insulation performance or seismic resistance that need to be numerically calculated, while others are designed to assess the number of environmental friendly measures taken. It should also be noted that not all of these are intended for evaluation of environmental performance. In particular, CASBEE for Home (Detached House) does not evaluate the following points in principle:

● Aesthetics

Although it is important for a house to have an attractive exterior and interior appearance, it is difficult to make an objective evaluation of "beauty." This aspect is therefore excluded. Q_H3.1, "Consideration of the Townscape and Landscape," which appears to be similar to this subjective evaluation item, in fact only deals with requirements that can be comparatively evaluated in an objective manner.

● Costs

High expenditures in order for a house to obtain a higher score in CASBEE (by the introduction of various measures) may sometimes be an unavoidable outcome, and this would surely be one of the important factors in a practical sense. However, it has been decided that assessment of costs should be left for the individuals concerned to judge, and costs have therefore been excluded from consideration in CASBEE.

● Individual lifestyles or preferences

Detached houses are often designed to match the occupants' lifestyle or preferences, so as to satisfy the occupants' wishes in these areas when so completed. However, this element is basically up to the individual's subjective feelings and defies objective judgment, so it is excluded from consideration in CASBEE. Nevertheless, some items that are considered to have a large impact on the building's environmental performance and allow for relatively clear-cut evaluation are included in the subjects of evaluation (Example: Q_H2.3.1, "Size and layout of rooms").

2.3 Point Allocation (Weighting) Policy

"Weighting coefficients" are used in the scoring of houses in CASBEE for Home (Detached House) by considering the relative importance of the assessment items. The weighting coefficients among major items (Q_H1, Q_H2, Q_H3, LR_H1, LR_H2, and LR_H3) were determined based on the results of calculations using the analytic hierarchy process (AHP)*, a statistical technique. The values used this version are <Q_H1:Q_H2:Q_H3 = 0.45:0.30:0.25> and <LR_H1:LR_H2:LR_H3 = 0.35:0.35:0.30>. On the other hand, the weighting coefficients for medium-level, minor, and scoring items under each major item were determined based on the results of discussions by specialists. The weighting coefficient for each item is shown in angle brackets in Table 1.2.

The weighting coefficients incorporate scientific findings as well as the judgments of various stakeholders including owners, housing suppliers, and administrative authorities based on their sense of values. Since these senses of values may change according to the situation, it is considered necessary to reexamine the weighting coefficients whenever this is judged to be appropriate.

* Weighting coefficients were determined based on the statistically processed results of questionnaires sent to stakeholders of CASBEE for Home (Detached House), including owners, housing suppliers, administrative officials, and scholars, regarding the relative importance of major items. The weighting coefficients resulting from this method reflect the differences in senses of values among individuals in their own capacity.

2.4 Relationship with Existing Systems

Detached houses are already covered by certification systems including the Japan Housing Performance Indication System and the Authorization System of Environmentally Symbiotic Housing in Japan (IBEC), as well as environmentally friendly design techniques such as the Design Guideline for Low-Energy Housing with Validated Effectiveness (IBEC).

With CASBEE for Home (Detached House), we have refined a simple assessment method that poses the least burden on assessors by using these already known and introduced systems and techniques. Particular attention has been paid to ensuring consistency between CASBEE for Home (Detached House) and these existing systems, and to avoiding the creation of a "double-standard" situation.

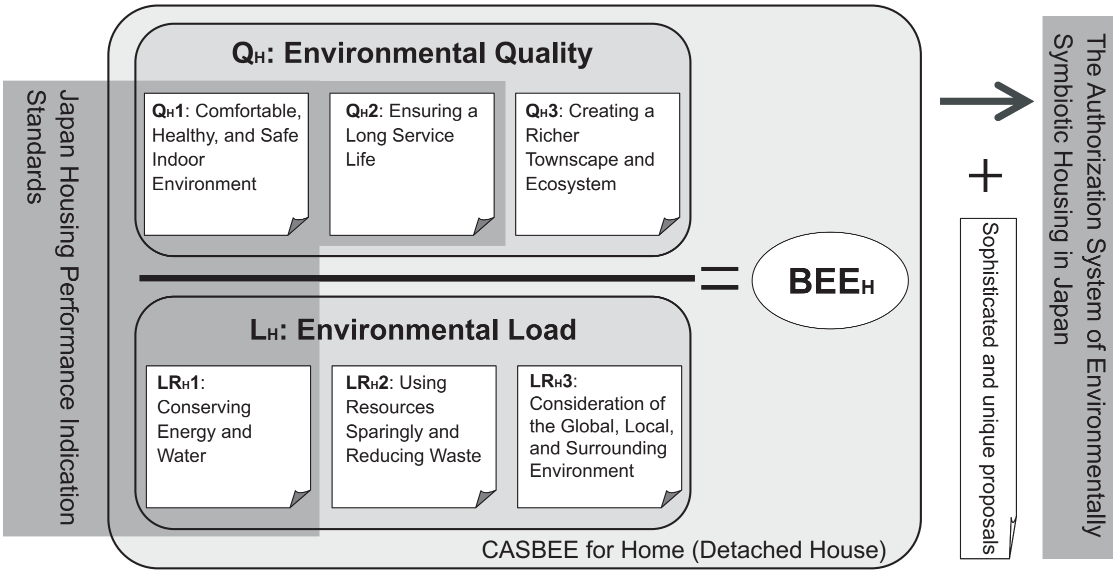


Fig. 1.6 Scope of assessment of CASBEE for Home (Detached House) and existing systems

Table 1.3 Relationship between CASBEE for Home (Detached House) and existing systems (as of September 2007)

	CASBEE for Home (Detached House)	Japan Housing Performance Indication System	The Authorization System of Environmentally Symbiotic Housing in Japan
Outline	Comprehensive assessment of detached houses (1) Viewpoint: Necessity of responding to environmental issues (social issues) including global warming (2) Assessment subjects: Environmental quality (Q) and environmental load reduction (LR) (3) Presentation: Presentation of the assessment results in five grades (rankings) for each category in a radar chart, etc. and calculation of Building Environmental Efficiency (BEE)	Assessment of houses (1) Viewpoint: Necessity of promoting housing quality and protecting purchasers' benefits (2) Assessment subjects: Performance of housing (including structural safety, fire safety, etc. but excluding environmental load outside the building) (3) Presentation: Presentation of the assessment results by grades or values for each performance item by means of housing performance assessment reports with a special signature on the front page	Comprehensive assessment of houses (1) Viewpoint: Necessity of preserving the global environment (2) Assessment subjects: "Preservation of the global environment," "friendliness with the surrounding environment," and "health and comfort of the living environment" (3) Presentation: Presentation of the assessment results for housing and its surrounding environment incorporated in a well-balanced manner in two stages: essential conditions and proposal
Objectives	- Benchmark to emphasize the advantage of high environmental performance to consumers and society - Evaluation indicator used when administrative regulatory initiatives are to be provided focusing on the comprehensive environmental performance of houses or on financial incentives or preferential treatment in order to promote environmentally friendly houses	- Acquisition of reliability in housing performance by third-party assessments including field inspections during construction and upon completion - Measure enabling consumers to select houses based on comparison of individual performances before concluding the purchase contract - Evaluation indicator used when administrative regulatory initiatives are to be provided focusing on specific individual performances or on preferential treatment in terms of finance or insurance in order to improve the quality of houses	- Clarification and diffusion of standards for environmentally symbiotic houses - Certification of houses that satisfy the basic requirements and for which sophisticated environmental actions or unique measures are implemented
	- Five-stage assessment for each assessment item (with Level 3 as the general standard); integration of the assessment results by means of weighting coefficients - Calculation of BEE (Building	- Assessment results of houses for each performance indication item in grades (with Grade 1 as the Building Standards Act compliance level) and values - Assessment in two stages based	- Certification of houses that satisfy the essential requirements of "energy saving," "sophisticated and effective use of resources," "local compatibility and environmental friendliness," and "health, comfort,

Assessment methods	Environmental Efficiency) in terms of Q (environmental quality) and LR (environmental load reduction), and evaluation of the results in five grades (S, A, B+, B-, and C)	on the assessment of design documents (design housing performance assessment) and the assessment of field inspections during construction and upon completion (construction housing performance assessment)	safety, and security" as prerequisites and, in addition, implement proposals judged to be highly sophisticated and unique in two or more patterns - Proposal requirements comprising innovativeness of ideas and designs resulting from free thinking; no restrictive criteria
	- At the current time, self-assessment is the basic rule. The CASBEE Accredited Professional Registration System (training → examination → registration) is to be established in the future to ensure reliability and transparency.	- A statutory third-party institution that conducts evaluation services is available to ensure performance reliability, but self-assessment is also permitted.	- A fair and independent third-party organization (Environmentally Symbiotic Housing Certification Committee) conducts evaluations, and IBEC provides certification.

3 How to Use CASBEE for Home (Detached House)

3.1 Who Will Find the System Useful

Expected users of CASBEE for Home (Detached House) include owners of houses, house purchasers, house architects, house suppliers, local governments, NPOs, and financial institutions.

3.2 How to Utilize the System

Environmental factors related to detached houses can be perceived and tackled in a variety of ways. It is no easy matter to share senses of values among the stakeholders listed above. This has made it difficult to realize appropriate environmentally conscious design of detached houses and prevented the diffusion of environmentally conscious houses.

CASBEE for Home (Detached House) was developed to enable sharing of the same sense of values concerning the environmental responses of detached houses among stakeholders by proposing common indexes for environmental quality and environmental load reduction measures that should be taken into consideration when a detached house is designed and built. There are four major ways in which CASBEE can be utilized, as described below.

① As a tool to realize environmentally friendly design for new houses

Architects will be able to set target levels of environmental performance and check the levels of attainment, and ultimately complete appropriate environmentally friendly design, by using CASBEE for Home (Detached House) to make a comprehensive review of the environmental performance of houses being designed.

② As a tool for communication among house owners, architects, and builders

Another effective use of CASBEE for Home (Detached House) is as a communication tool that will help owners, architects, and housing builders to sufficiently and thoroughly discuss architectural designs and techniques that can enhance housing environmental performance. Users of CASBEE for Home (Detached House) will not simply evaluate the specifications of the house itself; the evaluation items include such elements as home electric appliances brought in by the occupants and the provision of information to the occupants. Effective use of CASBEE for Home (Detached House) will allow the owner of a detached house and the architect who is to design the house to imagine how the owner will actually use the house and live there, and together work out the appropriate environmental performance of the house.

Appropriate use of CASBEE for Home (Detached House) will also allow housing suppliers to share the same understanding among the stakeholders during the design stage and help architects to effectively explain their intentions to contractors.

③ As an environmental labeling tool

When housing suppliers, local governments, or NPOs intend to sell or diffuse houses with superior environmental performance, they will be able to use the performance ranking results derived from CASBEE for Home (Detached House) to provide consumers with an easy-to-understand determination of the environmental performance of detached houses.

④ Application to private financial institutions

Since CASBEE for Home (Detached House) assesses houses in terms of a wide variety of efforts related to environmental factors, it can be used by financial institutions as a reference material to help them judge whether they will provide a house purchaser with a loan or preferential interest rate. Moreover, as CASBEE for Home (Detached House) assesses the life cycle CO_2 of houses and presents the results, it will assist in the diffusion of environmentally friendly houses for the prevention of global warming.

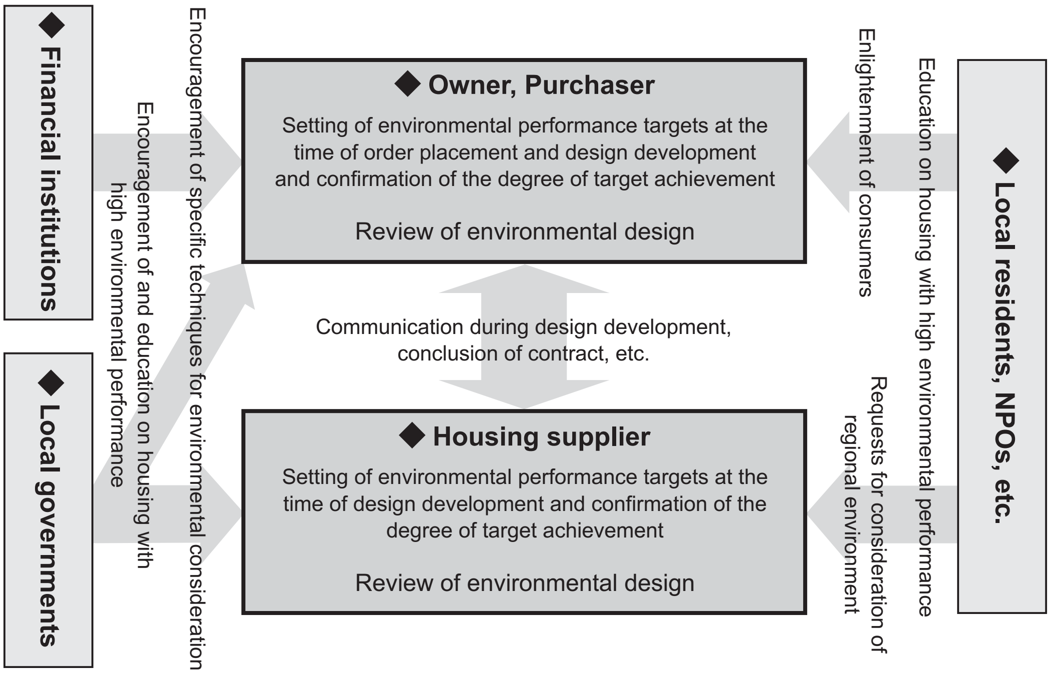


Fig. 1.7 Users of CASBEE for Home (Detached House) and its application

3.3 Rules for Presentation of Assessment Results

The assessment subjects of CASBEE for Home (Detached House) are extensive, ranging from building specifications, locations, plans, and external work, to equipment brought in by the occupants. The final assessment can therefore only be made when all conditions have been fully determined; that is, when the building has been completed and is occupied by the residents. However, since assessments are often required before all of the conditions have been established (at the early stage of design, for example), the system is designed to allow assessment even under assumed conditions.

In such a case, however, the assessment results may turn out to be different from the final assessment results. Therefore, when the assessment results of CASBEE for Home (Detached House) are presented to a third party, it is essential to provide accurate information to them regarding at what stage and under what conditions the assessment was made. Particularly when results are released to an unspecified number of people, such as data to be printed in catalogs or flyers, it is imperative that the results be presented with a proviso saying, for example, "These assessment results are based on some assumed conditions such as the site, family composition, usage, or external area," so as not to mislead the general public accessing the information.

Part II

Assessment Method of CASBEE for Home (Detached House)

1 Basic Policy of Assessment

Part II explains the method of assessment specific to CASBEE for Home (Detached House). Before describing the details, the basic policy for assessment is reviewed below.

* Note: This summary is a digest of the basic principles of assessment discussed in Part I and thereafter.

Subjects of assessment:

- CASBEE for Home (Detached House) makes a comprehensive assessment of the performance of a detached house in relation to the environment.
- In this context, CASBEE for Home (Detached House) assesses not only the building itself but also the external area of the house, equipment brought in by the occupants, information provided by the house supplier to the occupants, and actions during the member production stage and at the construction site.
- These subjects of assessment include items that building suppliers find it difficult to be directly involved in, but that have been selected as items to be assessed based on the judgment that they have an appreciable effect on the environment.

Policy related to assessment techniques:

- CASBEE for Home (Detached House) is not a tool intended for specialists only but was developed for use by a variety of people involved in housing construction. Because of this basic policy, CASBEE has adopted assessment techniques that are as easy as possible with the highest priority placed on no imposition of any special burden on the assessors.
- In specific terms, assessment techniques that would necessitate surveys, measurements, or complicated numerical analyses were not adopted, and preference was given to techniques that use simple calculations or make evaluations based on the number of environmentally conscious actions that have been taken.
- Various systems for the evaluation of detached houses have already been established, including assessment systems such as the Japan Housing Performance Indication Standards and the Environmentally Symbiotic Housing Certification System, as well as environmentally conscious design methods such as the Design Guidelines for Self-Cycling Residences. The evaluation of energy-consuming equipment, which is covered by the assessment of CASBEE for Home (Detached House), is carried out according to the Top Runner Standard as specified in the Act Concerning the Rational Use of Energy (also known as the Energy Conservation Law). CASBEE for Home (Detached House) allows the use of these already established and employed systems and techniques as well, so as to reduce the burden on assessors. Reference to the Japan Housing Performance Indication Standards, in particular, is permitted by CASBEE for Home (Detached House), and consistency with these systems and techniques is maintained with no double-standard situation occurring.

Policy related to level setting:

- The scoring levels are set so that a typical detached house as currently constructed in Japan is evaluated as Level 3.
- Some efforts or actions to be evaluated by CASBEE for Home (Detached House), which may seem relatively difficult to achieve at the present level of housing standards or technologies, have been set at Level 3 because they are judged to be those whose diffusion in the future should be promoted.

2 Assessment Method

2.1 Assessment Procedure

CASBEE for Home (Detached House) generally assesses a detached house following the procedure shown in Fig. 2.1. To begin with, the efforts made or actions taken with respect to a subject house are evaluated in five grades according to the scoring criteria in Part II, Section 3.3. The results are then expressed as scores. To simply this process, a dedicated software application has been developed. The software automatically carries out score calculations when the assessed levels are input and shows the assessment results including the BEE value in easy-to-understand presentations. The software is available for download free of charge on the IBEC website (http://www.ibec.or.jp/CASBEE/english/index.htm).

Although it is possible to make evaluations without using the software, complicated scoring calculations will be required. Therefore, use of the software is recommended where possible.

STEP 1

Evaluate the efforts made or actions taken for the subject house in five grades according to the rating criteria of CASBEE for Home (Detached House).

STEP 2

Input the level of each assessment item into the software.

STEP 3

Check the automatically calculated assessment results.

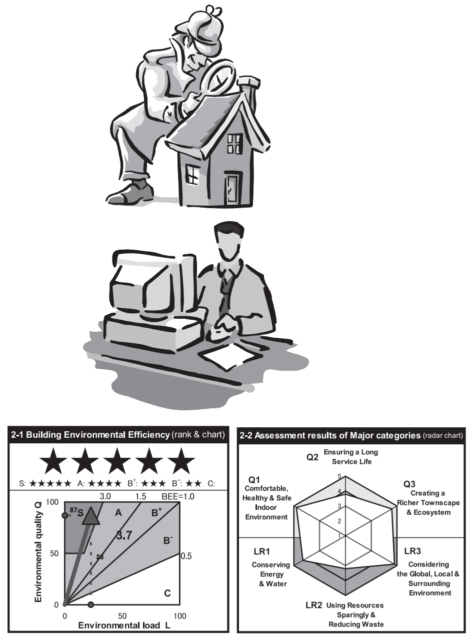


Fig. 2.1 Assessment procedure of CASBEE for Home (Detached House)

2.2 Assessment Technique Using the Software

(1) Overview of the software

The software used for assessment (named Assessment Software of CASBEE for Home (Detached House), hereinafter referred to as "the assessment software") consists of data files developed on Microsoft Excel 2003 for Windows XP. Therefore, Microsoft Excel 2003 for Windows XP (or a different version that allows sharing of the files) is necessary to use the assessment software.

The assessment software has a total of 14 sheets: "Main," "Considerations," "Q1 scoring," "Q2 scoring," "Q3 scoring," "LR1 scoring," "LR2 scoring," "LR3 scoring," "Scores," "CO2 calculation," "Results," "Weightings," "CO2 data," and "Credits." Input of data is required in eight of these sheets; namely, "Main," "Considerations," and "Q1 scoring" through "LR3 scoring."

The necessary entries are the basic information on the home to be assessed in the "Main" sheet (building name, location, structure and construction, area, year of completion, etc.), the specific considerations in design for each major item in the "Considerations" sheet, and the resultant levels derived from the assessment of each scoring item as per the scoring criteria in Part II, 3.3 (or options that have been selected such as the number or type of efforts made or actions taken). Specific efforts and actions implemented with respect to the subject house are also recorded.

Once the above operations are performed, the software automatically calculates the data using the information in the "Weightings" and "CO2 data" sheets and shows the assessment results in the "Results" sheet. It is possible to check the levels entered or the specific efforts and actions recorded in the "Scores" sheet and the values of the life cycle CO_2 calculation procedure in the "CO2 calculation" sheet. There is no set order of entry for these eight sheets. However, the "Results" sheet will not be fully completed unless all of the necessary information has been input.

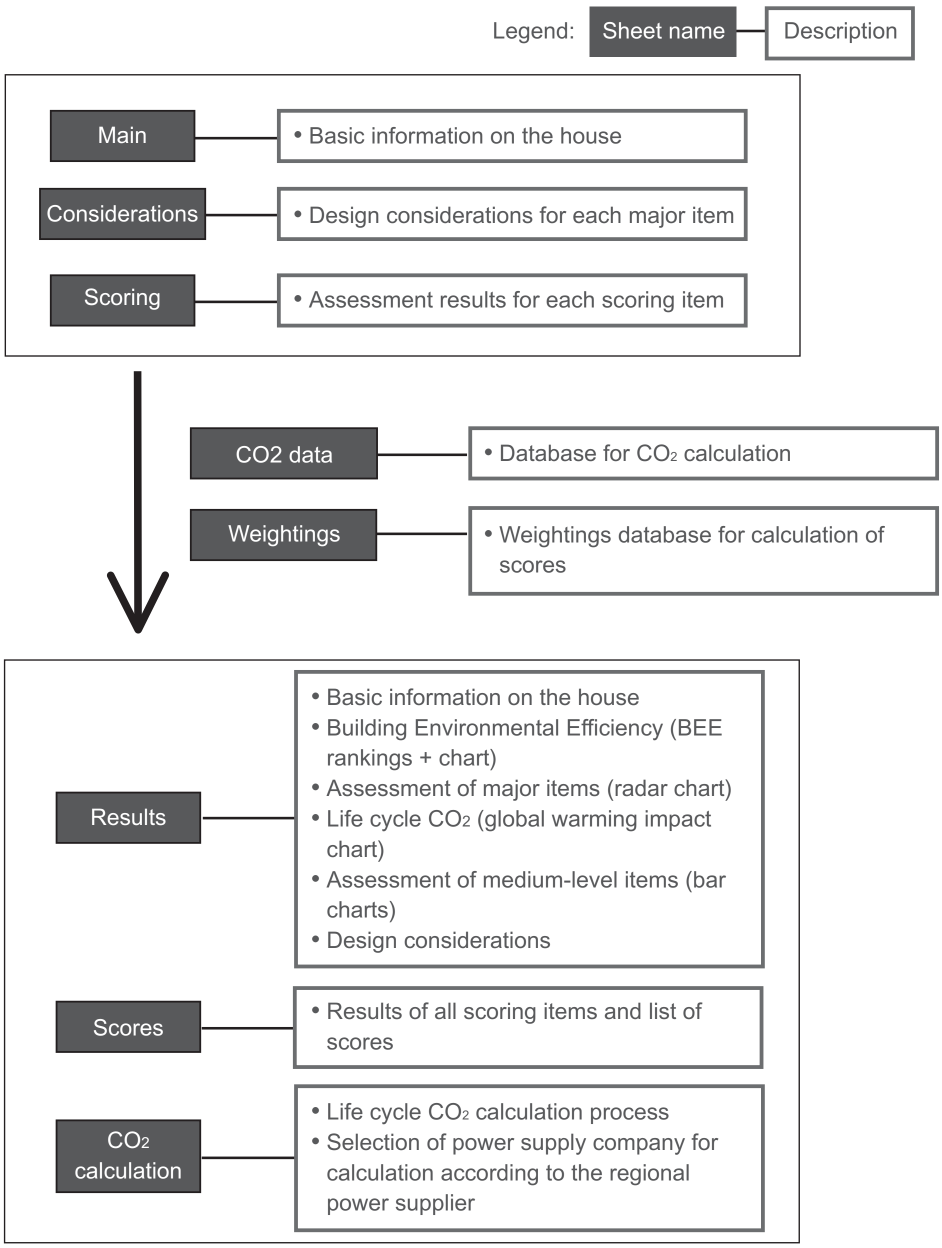


Fig. 2.2 Composition of the assessment software

2

(2) Entry of data in the "Main" sheet

Once you start up the assessment software, the sheet shown in Fig. 2.3 appears first.

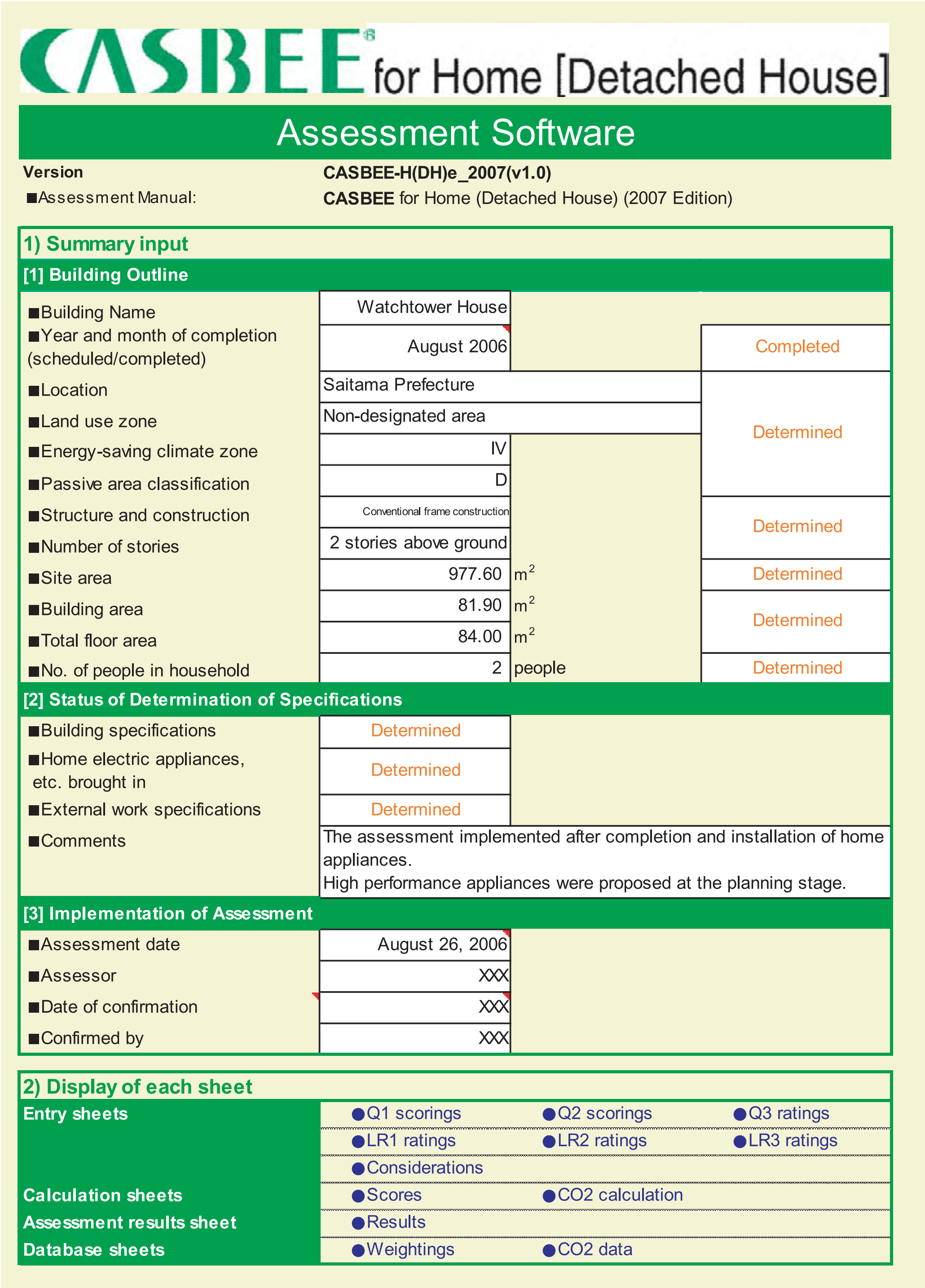


Fig. 2.3 Example of "Main" sheet

Detailed explanations are given below.

1) Summary input: ① Building Outline

This part is for input of the overall basic information on the house to be evaluated, such as the name, location, structure and construction, and area. Although this information is not used for calculation of the scores, it is transferred to other parts such as "1-1 Building Outline" in the "Results" sheet. The entry items "Energy-saving area classification" and "Passive area classification" indicate the heat-insulation area classification and the passive area classification based on the "Judgment Criteria for Building Owners for Energy Efficiency

Standards." These areas are judged by collating the address of the location with Reference 1 and Reference 2 in Part III, Section 3.2, "Reference Materials for Assessment."

For a stage where the evaluation conditions are yet to be determined, such as a case in which the location has been determined but the plan has not yet been finalized or where the conditions including the location are going to be reviewed, either "Scheduled" or "Tentative" in the selection cell on the right should be chosen, as appropriate. CASBEE for Home (Detached House) allows the user to make an "assumed" assessment of a house in its planning stage or a full assessment when all of the conditions have been determined. These entry cells are provided so as to accurately inform parties who see the results of the stage at which the assessment was made.

1) Summary input: ② Status of Determination of Specifications

As described above, select whether "Building specifications," "Home electric appliances, etc. brought in," and "External work specifications" are "Tentative," "Partly determined," or "Determined."

1) Summary input: ③ Implementation of Assessment

Input the date of assessment and the name of the assessor. When, for example, the assessment results are confirmed by a third party, the date of such confirmation and the name of the confirmer should also be entered.

2) Display of Each Sheet

When any sheet among "Entry sheets," "Calculation sheets," "Assessment results sheet," or "Database sheets" is selected, the selected sheet will be displayed on the screen. This is equivalent to the sheet tab function of Excel.

(3) Entry of data in the sheets from "Q1 scorings" to "LR3 scorings"

These sheets are for entry of the levels resulting from the evaluations made as described in Part II, Section 3.3, "Scoring criteria." There are six of these sheets in total, each dealing with one major item. Lists of the criteria for each scoring item are sequentially arranged in each sheet. The cells for which data entry is required in these sheets are those with a light-blue background.

1) Entry of the assessment results

① Basic entry method

The basic procedure is to move the cursor to any given cell with a light-blue background at the top left of the scoring criteria table, click on it to show the selectable levels, and select the appropriate level to complete the entry procedure. (Select "5" for Level 5, for example). The level selected is indicated by a black square (■). An example of a window with the entry process being performed is shown in Fig. 2.4.

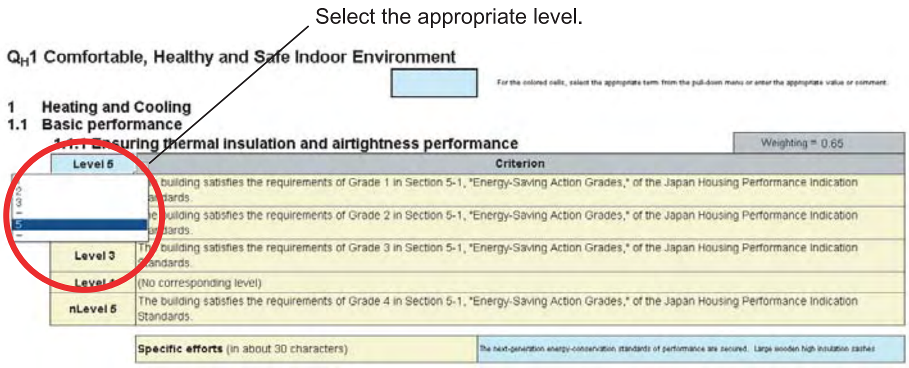


Fig. 2.4 Example of direct entry of level ("Q1 scorings" sheet)

Some scoring items are determined by the type or number of actions taken. For these items, the software is designed to automatically show the level when the user selects an action(s) or effort(s) or inputs the number of actions or efforts implemented. Examples of input are shown in Figs. 2.5 and 2.6. For these scoring items, the top left cells in the scoring criteria table do not have a light-blue background (that is, they cannot be selected).

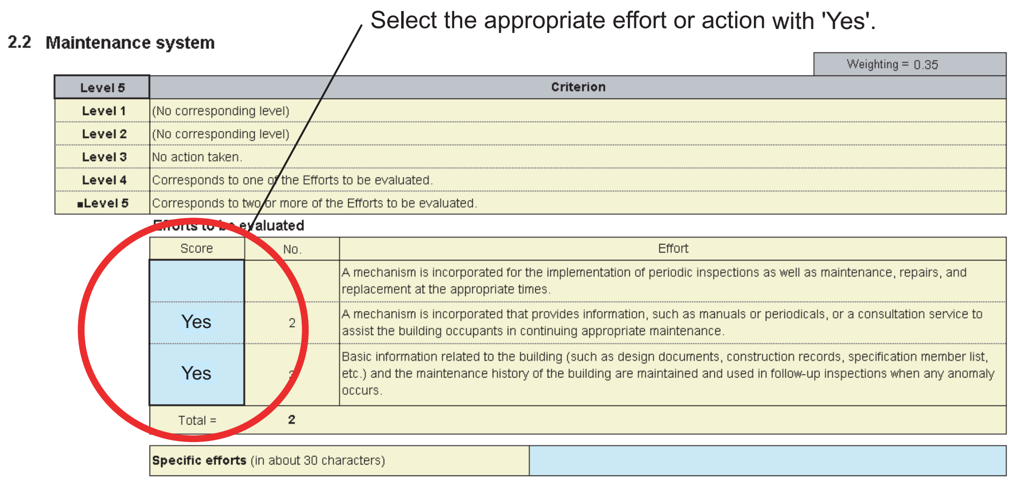


Fig. 2.5 Example of selection of actions or efforts ("Q2 scoring" sheet)

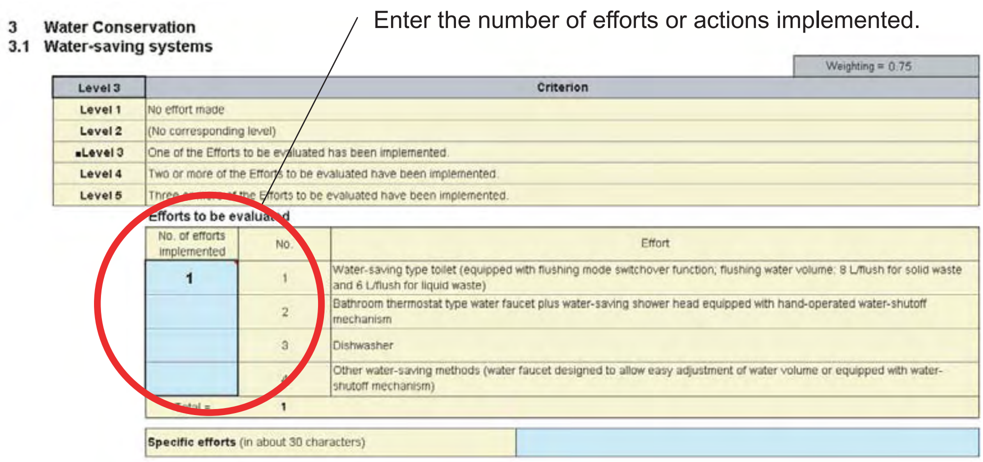


Fig. 2.6 Example of inputting the number of efforts or actions ("LR1 scoring" sheet)

Figure 2.7 shows an example of a scoring item with conditions for adding points. When the level before point addition in the cell with a light-blue background in the rating criteria table is selected and the appropriate combination in the conditions for adding points shown in the subsequent table is also selected, the level with a duly added point or points will be automatically shown in the cell above the light-blue-colored cell.

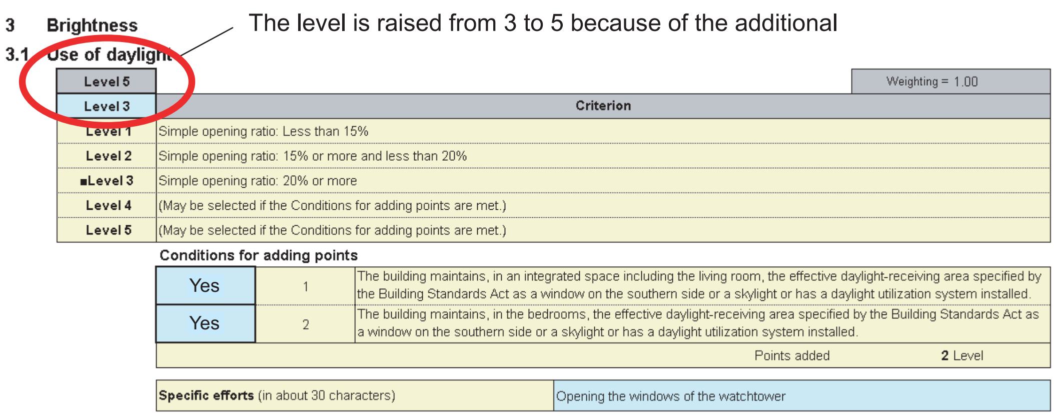


Fig. 2.7 Example of a scoring item with conditions for adding points ("Q1 scoring" sheet)

② Special entry method

Cases of special entry procedures are shown below:

■ Q_H2.1.3 Roof materials/flat roof

For this scoring item, the conditions for adding points differ between "Assessment based on the roofing material" and "Assessment based on the waterproofing layer." Select which type of assessment is appropriate in the top left cell of the "Conditions for adding points" table and then select the appropriate combination.

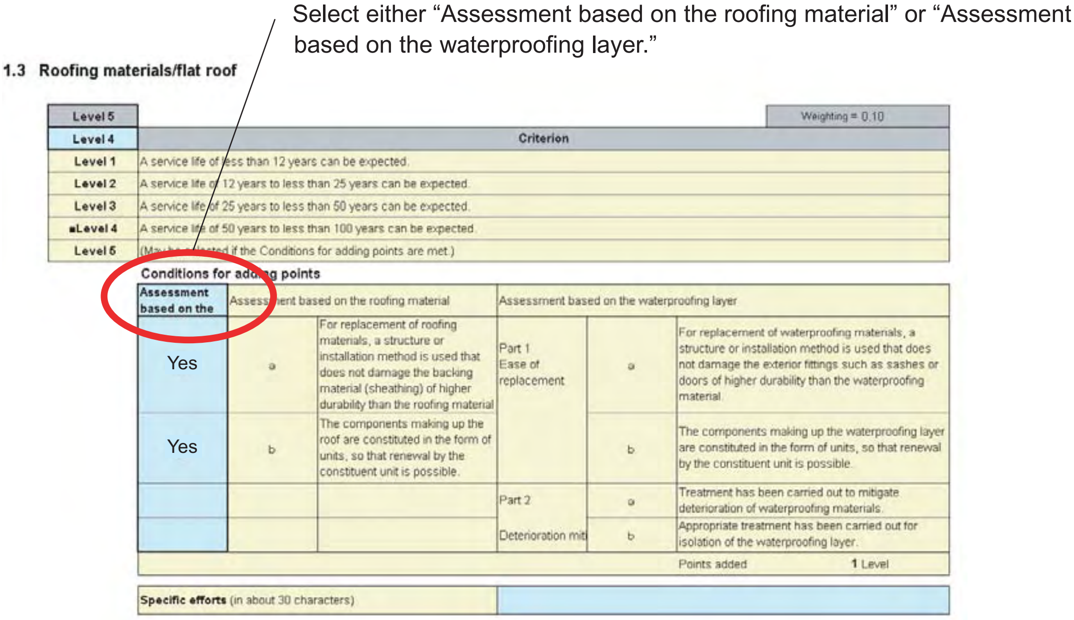


Fig. 2.8 Entry screen for "Q_H2.1.3 Roof materials/flat roof"

■ LR_H1.2.5.2 Solar power generation system

Enter a value in each of the "Power generated by solar power generation system" and "Primary energy consumption of entire building" cells for the "Solar power generation system" item.

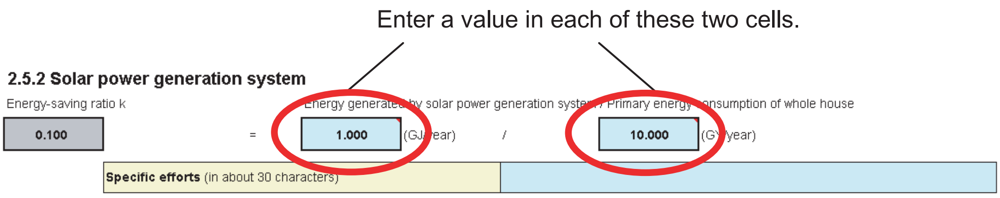


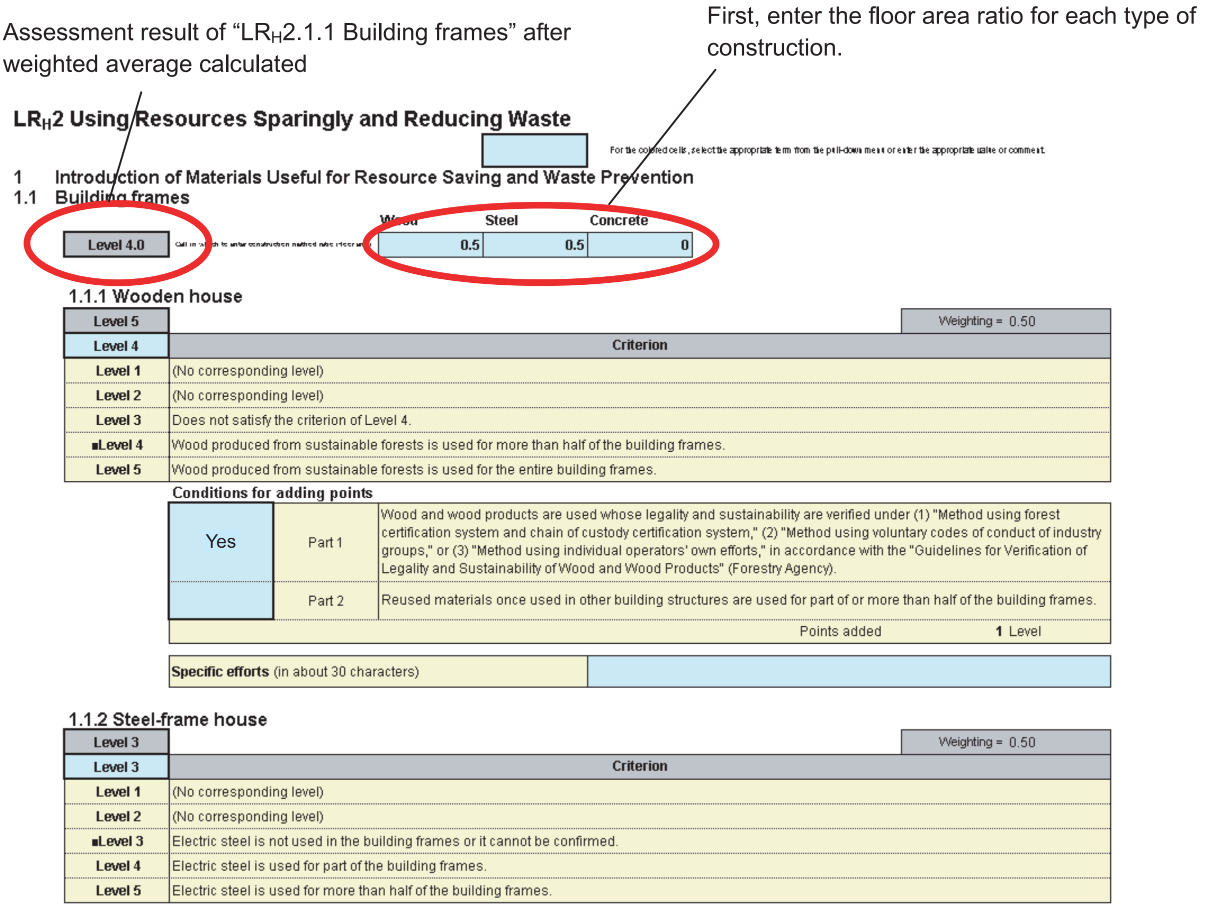
Fig. 2.9 Entry screen for "LR_H1.2.5.2 Solar power generation system"

■ LR_H2.1.1 Building frames

This item is composed of "LR_H2.1.1.1 Wooden house," "LR_H2.1.1.2 Steel-frame house," and "LR_H2.1.1.3 Concrete house," and entry cells are provided for each type of structure. Enter a value or values that give a total value of 1 by adding the ratio(s) of the floor area(s) of the appropriate structure(s) in the "Cell in which to enter construction method ratio (floor area)." For example, input "1" in the entry cell in the case of using a single type of construction, or the ratios in the case of using multiple types of construction.

For a case in which multiple types of construction are used, it is a rule to calculate the weighted average of each scoring result depending on the entered ratio. Figure 2.10 shows an example of a case where the ratio of wooden construction to steel-frame construction is 0.5:0.5. For the assessment result of each type of construction, the level of a wooden house is 5, while that of a steel-frame house is 3. Since the ratio of the floor area is the same in this case, the resultant level is 4. Note that the "Cell in which to enter construction method ratio (floor area)" will be shown in red if the values do not add up to 1. If this cell is shown in red, it is necessary to check the input values before the calculation can be correctly performed.

The assessment result of LR_H2.1.1 Building frames after the weighted average calculation is shown on the left of the construction method ratio cell.



Level 5		Weighting = 0.50
Level 4	Criterion	
Level 1	(No corresponding level)	
Level 2	(No corresponding level)	
Level 3	Does not satisfy the criterion of Level 4.	
■Level 4	Wood produced from sustainable forests is used for more than half of the building frames.	
Level 5	Wood produced from sustainable forests is used for the entire building frames.	

Conditions for adding points

Yes	Part 1	Wood and wood products are used whose legality and sustainability are verified under (1) "Method using forest certification system and chain of custody certification system," (2) "Method using voluntary codes of conduct of industry groups," or (3) "Method using individual operators' own efforts," in accordance with the "Guidelines for Verification of Legality and Sustainability of Wood and Wood Products" (Forestry Agency).
	Part 2	Reused materials once used in other building structures are used for part of or more than half of the building frames.
		Points added 1 Level

Specific efforts (in about 30 characters)	

1.1.2 Steel-frame house

Level 3		Weighting = 0.50
Level 3	Criterion	
Level 1	(No corresponding level)	
Level 2	(No corresponding level)	
■Level 3	Electric steel is not used in the building frames or it cannot be confirmed.	
Level 4	Electric steel is used for part of the building frames.	
Level 5	Electric steel is used for more than half of the building frames.	

Fig. 2.10 Entry screen of "LR_H2.1.1 Building frames"

2

③ Setting of "Assessment not applicable"

Some scoring items allow the user to select "Excluded." This is selected when it is judged that the item in question cannot be evaluated (or does not need to be evaluated), and the relevant judgment criteria are shown in the rating criteria. When this selection is made, the weighting for that item becomes 0, and it is proportionally allocated to other items of the same rank depending on the weighting. See Part II, Section 2.3, "Assessment Method by Manual Calculation," for details. (The expression "same rank" means that the item is either a scoring item, minor item, or medium-level item, and that if it is a detailed item, its weighting is distributed to other detailed items, while if it is a minor item, its weighting is distributed to other minor items.)

The scoring criterion for which "Assessment not applicable" is set may be selected as the lowest option. When "-" is shown in any option, this represents a level that is not set for the item in question (or for which assessment is not applicable), and if it is selected, an error will occur. (For example, in Fig. 2.4, "Level 4" and "Excluded" are indicated by "-.")

2) Entry in "Specific efforts" cells

The "Specific efforts" cell laid out below each scoring criteria table is for the entry of specific efforts or their features. For items that have been assessed as Level 4 or higher in particular, the reason for giving such a high evaluation should also be stated.

(4) Entries in the "Considerations" sheet

Figure 2.11 shows an example of descriptions of environmental considerations. In this sheet, enter design considerations and actual efforts implemented for each major item. Enter a general concept related to the entire building to be assessed in the "General" cell.

■Considerations in Environmental Design ■Building name: Watchtower House

	Considerations in Design
General	- The site is on agricultural land covered by paddy fields and upland fields, and the building stands on a vast compound covering of an area of over 300 tsubo that is surrounded by trees, bamboo thickets, and water channels on all four sides. Given these conditions, the aim has been to create a house in which the surrounding environment can be fully enjoyed. - The house, laid out on an existing platform about 1 m above the ground level, was designed to ensure good ventilation and lighting and a good view. - Special attention was paid to the texture of the materials used for the exterior and interior and to the comfort of the areas where family members gather.
Q_H1 Comfortable, Healthy and Safe Indoor Environment	- A next-generation heat insulation system and large insulated wooden sashes were used to reduce the cooling and heating loads. - Good ventilation and sunlight adjustment were taken into consideration. - Materials related to VOC, etc. were checked in advanced for their safety by MSDS. - Anti-crime glass was used for openings except for those of small size.
Q_H2 Ensuring a Long Service Life	- The appropriate type of foundation and its shape were studied and adopted based on a ground survey. - A timber framework method that features special joints and provides visual beauty, physical sturdiness, and high recoverability was adopted. - Highly durable building frames were realized by the installation of an underfloor ventilator, an exterior wall ventilation system, a continuous heat insulation compartment system, and dampproof sheeting.
Q_H3 Creating a Richer Townscape and Ecosystem	- Features include harmony with the surrounding houses, consistent design of the eaves and roof slope, and use of materials whose hue or texture change with the passage of time for the exterior walls. - Cypress produced in Saitama Prefecture was used for angle braces and struts that support the foundation and floor.
LR_H1 Conserving Energy and Water	- Passive energy-saving measures were adopted, and a natural coolant (CO2) type heat-pump water heater (COP 4.55) was used. - A 1.8 kW solar power generation system was installed on part of the pergola. - Fluorescent lights (incandescent bulb color) were used for lighting where possible. - Long-life products were used for lighting in places where replacement is difficult such as in the external area and watchtower.
LR_H2 Using Resources Sparingly and Reducing Waste	- Recycled heat insulant made of PET bottles was applied to the exterior walls. - Although no active measures were taken to reduce waste during the production stage, materials related to recycling promotion were handed to contractors and subcontractors at the construction site to explain its importance before commencement of the work.
LR_H3 Consideration of the Global, Local and Surrounding Environment	- Existing trees were left in place where possible, and newly planted trees were mainly chosen from among the species actually growing in the local woods. - New cool spots were created around the house by planting new trees in conjunction with the green shade of the pergola in the northern garden, the existing homestead wood, and the waterfront so as to create a comfortable microclimate that ensures health and seasonal beauty.
Others	- The platform was constructed by the owner about 10 years ago when an old private house that had been constructed in the Edo Period was torn down for the purpose of building a new house, in order to remember the former building.

Fig. 2.11 Example of "Considerations" sheet

(5) How to read the "Results" sheet

Figure 2.12 shows a sample "Results" sheet. All of the information entered and the calculated results are shown here. That is, this sheet alone can provide an outline of the assessment results of the house being evaluated. This sheet is expected to be used for discussions and meetings in the design stage or contract stage and is therefore designed to be printed in A4 format. The following is an explanation of the contents of this sheet and how to read it.

(Displayed contents)

1-1 Building Outline
The information entered in the "Main" sheet is shown. There is a space to insert a perspective view or photo as required.

2-1 Building Environmental Efficiency
Results of the comprehensive assessment

2-2 Assessment of Major Items
Score of each major item

2-3 Life Cycle CO_2
Results of life cycle CO_2 calculation

2-4 Assessment of Medium-Level Items
Score of each medium-level item

3 Design Considerations
The information entered in the "Considerations" sheet is shown.

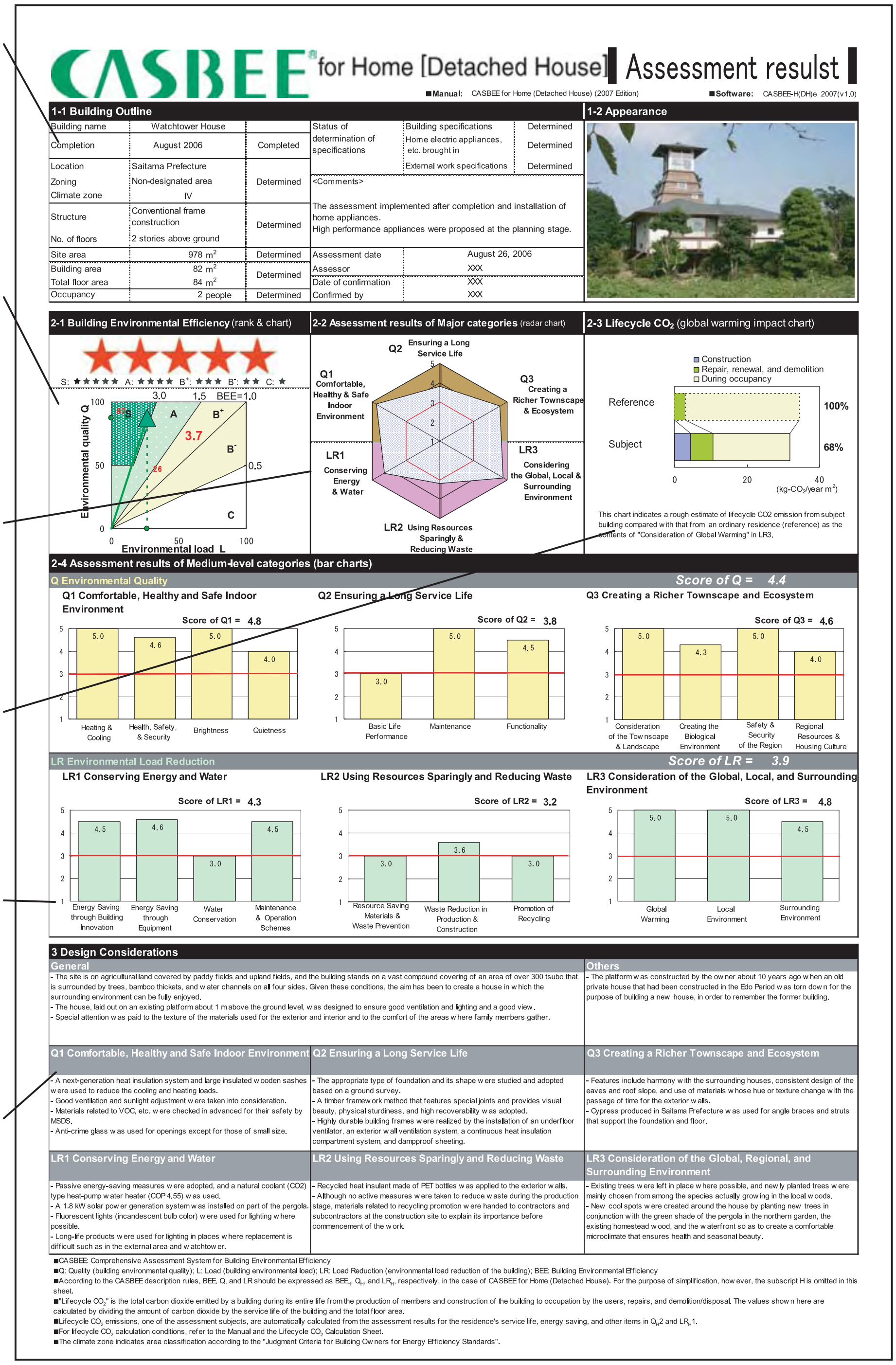


Fig. 2.12 Example of "Results" sheet

As shown in Fig. 2.12, this sheet contains three types of information: an outline of the building, the assessment results, and design considerations.

Among these, the assessment results are composed of four types of graphs.

"2-1 Building Environmental Efficiency (BEE rank & chart)" (Fig. 2.13) shows the BEE_H value and the ranking from S to C.

"2-2 Assessment results of Major categories (radar chart)" (Fig. 2.14) allows the user to check the balance of efforts for the six major items. The score of 3 is shown in red because this level is the assessment benchmark for ordinary houses. If a house is given a score higher than Level 3, this means that more than average efforts have been made.

"2-4 Assessment results of Medium-Level categories (bar charts)" (Fig. 2.15) has six graphs, one for each of the six major items of Q_H and L_H, and the results of the medium-level items are shown in a bar graph (bar chart) in each of those categories. The score of 3 on the vertical axis is shown as a red line because, as with the radar chart mentioned above, it is the assessment benchmark for comparison with ordinary houses.

"2-3 Life Cycle CO_2 (global warming impact chart)" (Fig. 2.16) rearranges the contents of "LR_H3.1 Consideration of Global Warming" in the life cycle CO_2 emission rates compared with an ordinary residence (reference value). The values on the right of the graph indicate the CO_2 emission rate with the reference value set at 100%. The smaller the value, the more effective the anti-warming action. This chart is explained in detail in Part III, Section 2, "Life Cycle CO_2."

As explained above, the user can check the comprehensive assessment results from "2-1 Building Environmental Efficiency (BEE rank & chart)" and learn what efforts in what category are highly evaluated or poorly evaluated from three graphs. One of the primary purposes of CASBEE for Home (Detached House) is to facilitate the incorporation of the analysis results into the actual design work, which is of great importance in order to increase the number of quality houses.

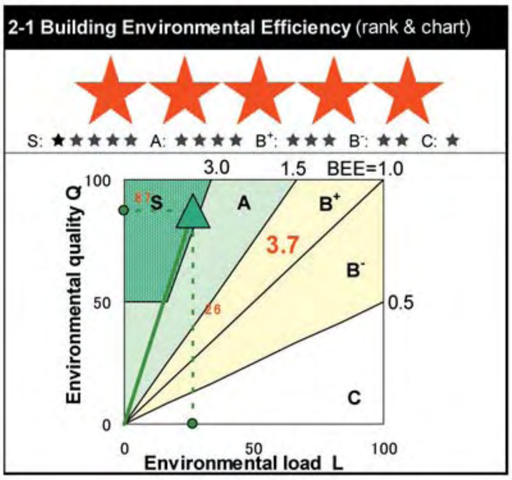


Fig. 2.13 Example of "2-1 Building Environmental Efficiency (BEE rank & chart)"

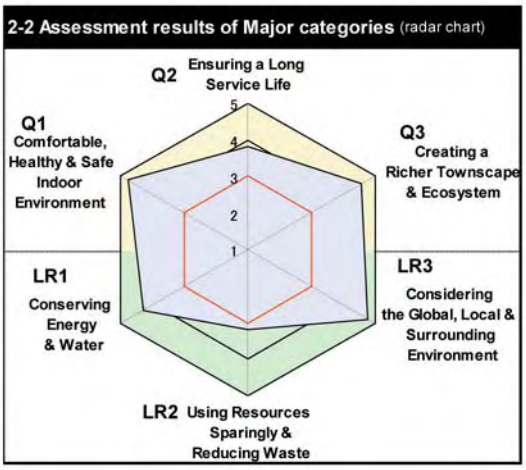


Fig. 2.14 Example of "2-2 Assessment results of Major categories (radar chart)"

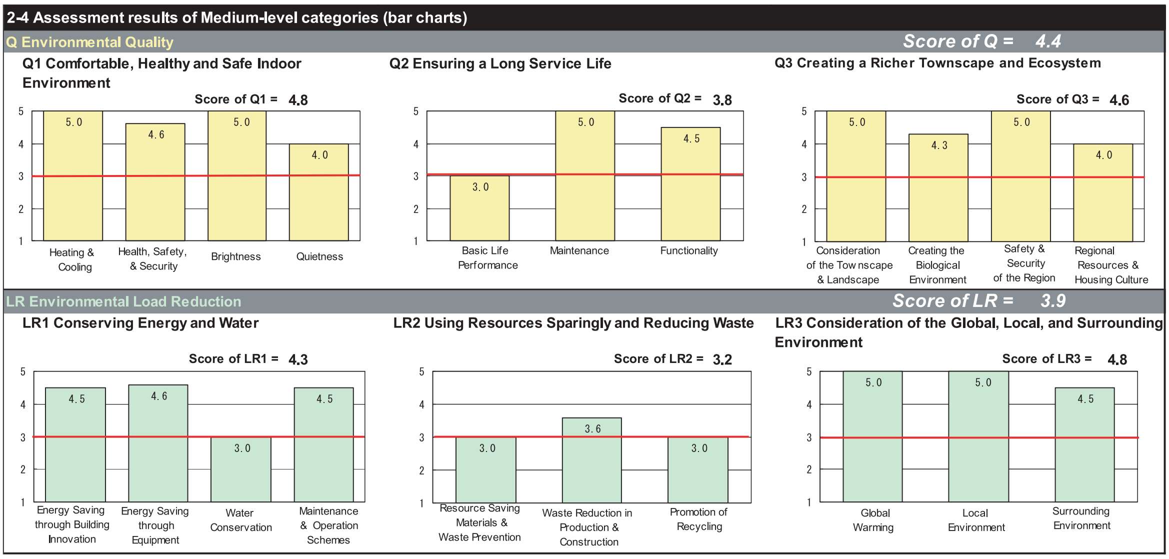


Fig. 2.15 Example of "2-4 Assessment results of Medium-Level categories (bar charts)"

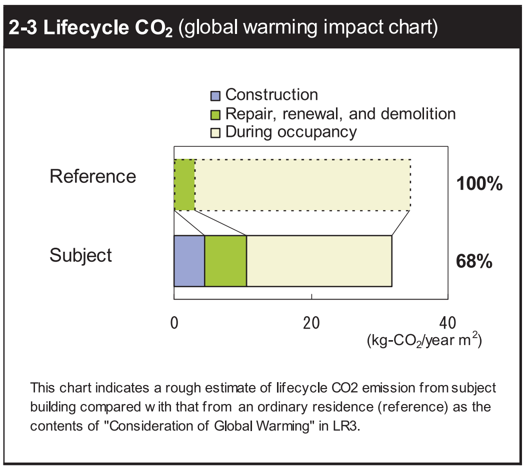


Fig. 2.16 Example of "2-3 Life Cycle CO_2 (global warming impact chart)"

In the final section, "3 Design Considerations," it is recommended that descriptions be given of specific efforts made with respect to the house being assessed, as well as the characteristics of efforts that cannot be fully expressed by graphical presentation or other efforts or actions that are not the subjects of CASBEE scoring criteria but may serve as appealing features of the house.

(6) How to read the "Scores" sheet

The "Scores" sheet shows the "specific efforts" entered in each scoring sheet and the assessment results (which are shown here as the "Score"). In addition, Q_H and L_H, calculated by using the "Weighting coefficient" shown on the right of the "Score" column as well as the scores by the major or medium-level items are also shown. In other words, this sheet is a list of the assessment results and scores of all scoring items and allows the user to check these with the "Results" sheet to make a more detailed analysis. The sheet may also be used to identify any erroneous entries or presentations in the six scoring sheets.

Figure 2.17 shows an example of the Q_H1 section of this sheet. The "Score" column displays the results of assessments based on the information entered in the "Q1 ratings" sheet, and the "Total" column shows the results converted to scores using the weightings in the "Weighting coefficient" column. In this example, we can see that the score of the medium-level item "Heating and Cooling" is 5, the score of the major item " Comfortable, Healthy, and Safe Indoor Environment " is 4.8, and the Q_H score is 4.4 (score conversion is explained in the next section).

CASBEE for Home (Detached House) (2007 Edition)
Watchtower House

■Assessment manual: CASBEE for Home (Detached House) (2007 Edition)
■Assessment software: CASBEE-H(DH)e_2007(v1.0)

Scores Sheet				
Considered items	**List of specific efforts**	**Score**	Weighting coefficient	**Total**
Q_H Environmental Quality of the Building				**4.4**
Q_H1 Comfortable, Healthy, and Safe Indoor Environment			0.45	**4.8**
1 Heating and Cooling		**5.0**	0.50	**5.0**
1.1 Basic performance		**5.0**	0.50	
1 Ensuring thermal insulation and airtightness performance	The next-generation energy-conservation standards of performance are secured. Large wooden high insulation	5.0	0.65	
2 Sunlight adjustment capability	Large wooden high insulation sashes were installed.	5.0	0.35	
1.2 Preventing summer heat		**5.0**	0.25	
1 Allowing breezes in and heat out	Paths for the wind based on research, and sashes safely opened during the night,	5.0	0.50	
2 Proper planning for cooling	Appropriate capacity for heating equipment	5.0	0.50	
1.3 Preventing winter cold		**5.0**	0.25	
1 Proper planning for heating	–	5.0	1.00	
2 Health, Safety, and Security		**4.6**	0.30	**4.6**
2.1 Countermeasures against chemical contaminants	F★★★★ equivalent materials, confirmed using Material Safety Data Sheets (MSDS).	**5.0**	0.33	
2.2 Proper planning for ventilation	Watchtower useful for natural ventilation by the vertical temperature (and pressure) variations	**5.0**	0.33	
2.3 Precautions against crime	Security glass and a double-locking mechanism were installed in the main door	**4.0**	0.33	
3 Brightness		**5.0**	0.10	**5.0**
3.1 Use of daylight	Opening the windows of the watchtower	**5.0**	1.00	
4 Quietness	–	**4.0**	0.10	**4.0**

Fig. 2.17 Example of "Scores" sheet (extract)

(7) "CO2 calculation" sheet

This sheet displays the life cycle CO_2 calculation processes. The calculation results here are used as the data for evaluation of "LR_H3.1 Consideration of Global Warming," as well as "2-3 Life Cycle CO_2 (global warming impact chart)" in the "Results" sheet. See Part III, Section 2, "Life Cycle CO_2," for details.

2.3 Assessment Method by Manual Calculation - Scoring Method of CASBEE for Home (Detached House)

CASBEE for Home (Detached House) allows the user to make assessments based on manual calculations, but since this makes the calculation of scores very complicated, use of the assessment software is recommended where possible. If the user has no PC or Microsoft Excel is not installed, however, an assessment can be made using the following method.

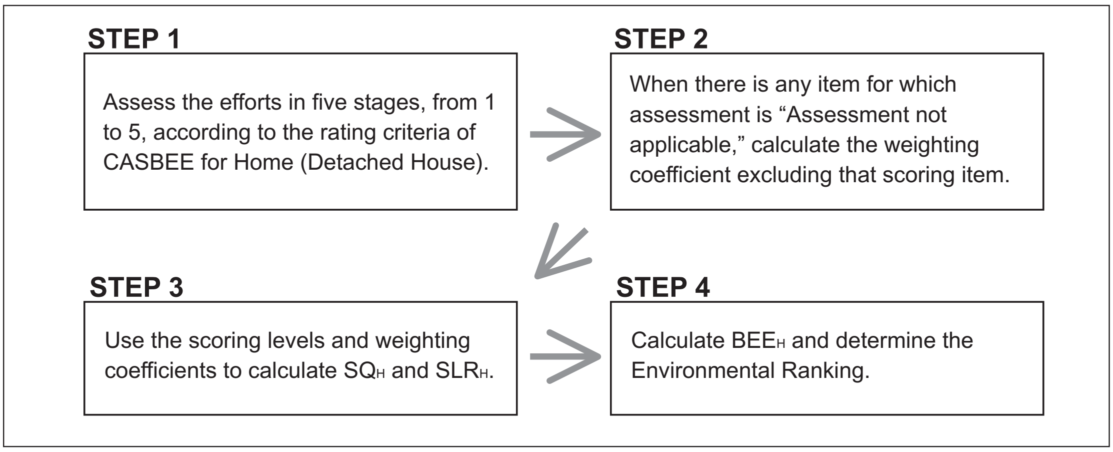


Fig. 2.18 Assessment procedure for CASBEE for Home (Detached House) (in case of manual calculation)

The reason why the calculation of scores becomes complicated is that when there is an "Assessment not applicable" item, it is necessary to recalculate the weighting allocation. The calculation methods when recalculation is necessary and not necessary are respectively shown below.

2

<u>Case with no "Assessment not applicable" items</u>

The approach in Step 1 is exactly the same as when the software is used. If, after the assessment, it is found that there are no "Assessment not applicable" items, omit Step 2 and go to the Step 3 calculation. The weighting coefficients used here are those shown in Part I, Table 2.2. Using Q_H1 as an example, the method of calculating SQ_H1 ("S" indicates "Score"), the total of all the assessment items contained in Q_H1, is described below. Table 2.1 shows the weighting coefficients for Q_H1 and an example of the score level assessed based on the scoring criteria.

Table 2.1 Q_H1 assessment items and examples of score levels
* Values in < > are weighting coefficients.

Q_H1 Comfortable, Healthy and Safe Indoor Environment			Score level
Medium-level items	Minor items	Detailed items	
1. Heating and Cooling <0.50>	1.1 Basic performance <0.50>	1.1.1 Ensuring thermal insulation and airtightness performance <0.65>	3
		1.1.2 Sunlight adjustment capability <0.35>	3
	1.2 Preventing summer heat <0.25>	1.2.1 Allowing breezes in and heat out <0.50>	3
		1.2.2 Proper planning for cooling <0.50>	5
	1.3 Preventing winter cold <0.25>	1.3.1 Proper planning for heating <->	3
2. Health, Safety, and Security <0.30>	2.1 Countermeasures against chemical contaminants <0.33>		3
	2.2 Proper planning for ventilation <0.33>		1
	2.3 Precautions against crime <0.33>		3
3. Brightness<0.10>	3.1 Use of daylight <1.00>		5
4. Quietness <0.10>			4

To begin with, calculate score $SQ_H1.1$ for "1.1 Basic performance" under "1. Heating and Cooling." This minor item has two scoring items. Use the weighting coefficients and score levels of these two items and carry out the following weighted mean calculation:

$$SQ_H1.1 = 0.65 \times 3 + 0.35 \times 3 = 3.$$

Carry out the calculation for "1.2 Preventing summer heat" in the same way:

$$SQ_H1.2 = 0.50 \times 3 + 0.50 \times 5 = 4.$$

Next, calculate score SQ_H1 for "1 Heating and Cooling":

$$\begin{aligned} SQ_H1 &= 0.50 \times SQ_H1.1 + 0.25 \times SQ_H1.2 + 0.25 \times 3 \\ &= 0.50 \times 3 + 0.25 \times 4 + 0.25 \times 3 \\ &= 3.25. \end{aligned}$$

Perform the calculations for the other medium-level items and then for the major items to finally obtain SQ_H1. In the above example, SQ_H1 turned out to be 3.3. Repeat this calculation process for the other major items, and you will finally obtain SQ_H and SLR_H by weighted average calculations using the results and weighting coefficients for the major items.

Next, we describe how to calculate BEE_H. While SQ_H and SLR_H are divided into a scale of five levels, from 1 to 5, BEE_H is assessed on a scale of 0 to 100 (see Part I, Section 2.1, "Basic Structure of Assessment"). The following equations are used to convert the scales:

$$Q_H = 25 \times (SQ_H - 1),$$

$$L_H = 25 \times (5 - SLR_H).$$

Here, SLR_H, which is the load reduction performance (the larger, the better), is converted to index L_H for environmental load (the larger, the worse). Based on Q_H and L_H thus calculated, the environmental efficiency of the house BEE_H is obtained by the following equation:

$$\text{Building Environmental Efficiency } BEE_H = \frac{Q_H : \text{Environmental Quality}}{L_H : \text{Environmental Load}}$$

Lastly, use this result to collate with Table 1.1 in Part I, to determine the environmental ranking.

Case with "Assessment not applicable" item(s)

Steps 1, 3, and 4 in Fig. 2.18 are identical to those for the case with no "Assessment not applicable" items. Here is a method for weighting coefficient correction for an example where "1.1.2 Sunlight adjustment capability" and "1.3.1 Proper planning for heating" are designated as "Assessment not applicable" items.

Table 2.2 Assessment items and weighting coefficients (before correction) for $Q_H1.1$

Q_H1 Comfortable, Healthy and Safe Indoor Environment			Score level
Medium-level items	Minor items	Detailed items	
1. Heating and Cooling <0.50>	1.1 Basic performance <0.50>	1.1.1 Ensuring thermal insulation and airtightness performance <0.65>	3
		1.1.2 Sunlight adjustment capability <0.35>	Assessment not applicable
	1.2 Preventing summer heat <0.25>	1.2.1 Allowing breezes in and heat out <0.50>	3
		1.2.2 Proper planning for cooling <0.50>	5
	1.3 Preventing winter cold <0.25>	1.3.1 Proper planning for heating <->	Assessment not applicable

Values in < > are the weighting coefficient in the initial condition shown in Table 2.1. When 1.1.2 becomes "Assessment not applicable," the weighting coefficient for "1.1.2 Sunlight adjustment capability" changes from 0.35 to 0, and this decrement is added to the weighting coefficient for "1.1.1 Ensuring thermal insulation and airtightness performance" to increase it from 0.65 to 1.0. This means that since "Sunlight adjustment capability" cannot be implemented, "Ensuring thermal insulation and airtightness performance" is emphasized more instead.

On the other hand, if "1.3.1 Proper planning for heating" is "Assessment not applicable," that is, "1.3 Preventing winter cold" is also excluded from assessment, the weighting coefficient 0.25 is distributed to "1.1 Basic performance" and "1.2 Preventing summer heat" according to each weighting coefficient, as follows:

Weighting coefficient for "1.1 Basic performance"

$$= 0.50 + \underline{0.25 \times 0.50 \div (0.50 + 0.25)}$$

$$= 0.67.$$

(0.25 for "1.3 Preventing winter cold" is distributed as per the weighting of "1.1 Basic Performance.")

Weighting coefficient for "1.2 Preventing summer heat"

$$= 0.25 + \underline{0.25 \times 0.25 \div (0.50 + 0.25)}$$

$$= 0.33.$$

(0.25 for "1.3 Preventing winter cold" is distributed as per the weighting of "1.2 Preventing summer heat.")

Now the weighting coefficients after correction are as shown in Table 2.3.

Table 2.3 Assessment items and weighting coefficients for $Q_H1.1$ (after correction)

Q_H1 Comfortable, Healthy and Safe Indoor Environment			Score level
Medium-level items	Minor items	Detailed items	
1. Heating and Cooling <0.50>	1.1 Basic performance <0.67>	1.1.1 Ensuring thermal insulation and airtightness performance <1.00>	3
		1.1.2 Sunlight adjustment capability <0.00>	Assessment not applicable
	1.2 Preventing summer heat <0.33>	1.2.1 Allowing breezes in and heat out <0.50>	3
		1.2.2 Proper planning for cooling <0.50>	5
	1.3 Preventing winter cold <0.00>	1.3.1 Proper planning for heating <->	Assessment not applicable

As explained above, the user can complete the scoring process by carrying out Steps 3 and 4 after recalculating the weighting for all relevant items.

3 Scoring criteria

3.1 List of Scoring Criteria

A list of the scoring criteria is shown in Table 2.4.

Table 2.4 List of assessment items in CASBEE for Home (Detached House)

$Q_{H}1$ Comfortable, Healthy and Safe Indoor Environment

Medium-level items	Minor items	Detailed items	Page
1. Heating and Cooling	1.1 Basic performance	1.1.1 Ensuring thermal insulation and airtightness performance	38
		1.1.2 Sunlight adjustment capability	39
	1.2 Preventing summer heat	1.2.1 Allowing breezes in and heat out	41
		1.2.2 Proper planning for cooling	42
	1.3 Preventing winter cold	1.3.1 Proper planning for heating	44
2. Health, Safety, and Security	2.1 Countermeasures against chemical contaminants		47
	2.2 Proper planning for ventilation		48
	2.3 Precautions against crime		49
3. Brightness	3.1 Use of daylight		51
4. Quietness			52

$Q_{H}2$ Ensuring a Long Service Life

Medium-level items	Minor items	Detailed items	Page
1. Basic Life Performance	1.1 Building frames		54
	1.2 Exterior wall materials		55
	1.3 Roof materials/flat roof		58
	1.4 Resistance against natural disasters		62 63
	1.5 Fire preparedness	1.5.1 Fire-resistant structure (excluding openings)	64 65
2. Maintenance	2.1 Ease of maintenance	1.5.2 Early detection of fire	67
	2.2 Maintenance system		70
3. Functionality	3.1 Size and layout of rooms		73
	3.2 Barrier-free design		

$Q_{H}3$ Creating a Richer Townscape and Ecosystem

Medium-level items	Minor items	Detailed items	Page
1. Consideration of the Townscape and Landscape			74
2. Creating the Biological Environment	2.1 Greening of the premises		76
	2.2 Ensuring the biological habitat		80
3. Safety and Security of the Region			83
4. Utilizing Regional Resources and Inheriting the Regional Housing Culture			85

$LR_{H}1$ Conserving Energy and Water

Medium-level items	Minor items	Detailed items	Page
1. Energy Saving through Building	1.1 Control of thermal load of building		88

Innovation	1.2 Natural energy use		89
2. Energy Saving through Equipment Performance	2.1 Air-conditioning systems	2.1.1 Heating system	93
		2.1.2 Cooling system	95
	2.2 Hot-water equipment	2.2.1 Hot-water supply equipment	97
		2.2.2 Heat insulation of bathtub	98
		2.2.3 Hot-water plumbing	102
	2.3 Lighting fixtures, home electric appliances, and kitchen equipment		103
	2.4 Ventilation system		105
	2.5 Highly energy-efficient equipment	2.5.1 Home cogeneration system	106
		2.5.2 Solar power generation system	108
3. Water Conservation	3.1 Water-saving systems		111
	3.2 Rainwater use		112
4. Well-Informed Maintenance and Operation Schemes	4.1 Presentation of lifestyle advice		113
	4.2 Management and control of energy		114

LR_H2 Using Resources Sparingly and Reducing Waste

Medium-level items	Minor items	Detailed items	Page
1. Introduction of Materials Useful for Resource Saving and Waste Prevention	1.1 Building frames		116
		1.1.1 Wooden house	121
		1.1.2 Steel-frame house	122
		1.1.3 Concrete house	123
	1.2 Ground-reinforcing materials, foundation work, and foundations		125
	1.3 Exterior materials		126
	1.4 Interior materials		128
	1.5 Materials for the external area		132
2. Reduction of Waste in the Production and Construction Stages	2.1 Production stage (members for building frames)		133
	2.2 Production stage (members other than those for building frames)		134
	2.3 Construction stage		135
3. Promotion of Recycling	3.1 Provision of information on materials used		136

LR_H3 Consideration of the Global, Local, and Surrounding Environment

Medium-level items	Minor items	Detailed items	Page
1. Consideration of Global Warming			138
2. Consideration of the Local Environment	2.1 Control of the burden on the local infrastructure		140
	2.2 Preservation of the existing natural environment		142
3. Consideration of the Surrounding Environment	3.1 Reduction of noise, vibration, exhaust, and exhaust heat		146
	3.2 Improvement of the thermal environment of the surrounding area		148

3.2 How to Read the Scoring Criteria

The scoring criteria are compiled by page for each scoring item and are basically composed of three parts: ■ "Assessment Item," ■ "Assessment Level," and ■ "Description." In addition to these, ■ "Explanation of Terminology (Definitions)," "Supplementary Description," and "Reference" may be added as required. The purpose of each part is explained below.

2

■ Assessment Item

The viewpoint of assessment is explained. In principle, this part explains "what is assessed by what standard or what policy."

■ Assessment Level

The levels in up to five stages and their corresponding rating criteria are shown in this part. Any level stated as having "No corresponding level" is treated as if it does not exist. In the example of Q_H1.1.1.1 in Fig. 2.19, there is no evaluation as Level 4, which means the assessment is made in four stages.

Three items of supplementary information related to assessment are also shown below the assessment level table. They have the following definitions:

Availability of conditions for adding points

In CASBEE for Home (Detached House), when a house has been assessed by the scoring criteria in the ■ "Assessment Level" column, it may be possible to raise the level when additional efforts are made based on certain conditions. If this system is available, "Available" is shown, while if it is not available, "None" is shown. In the case of "Available," the condition that allows the level to be increased is described in the "Conditions for adding points" column in the ■ "Description."

Level change according to conditions

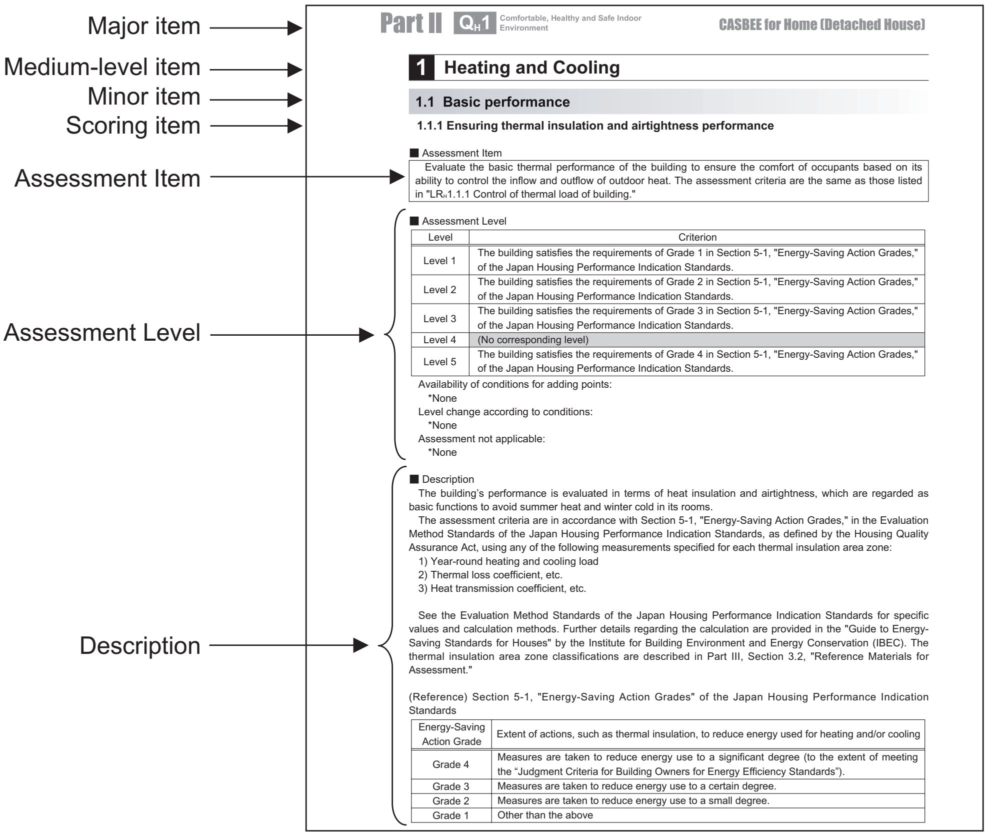
If a level is determined by a certain condition regardless of the description in ■ "Assessment Level" or ■ "Description," that condition is described here.

Assessment not applicable

In CASBEE for Home (Detached House), it is a basic principle to assess all items. However, when some item does not need to be evaluated or cannot be evaluated for any of various reasons including locational restrictions, absence of equipment to make an evaluation, or restrictions imposed by the Building Standards Act, a house may be assessed with no evaluation made for such an item, which is designated as "Assessment not applicable." This is where such a condition is specified.

■ Description

The information necessary for assessment is explained in detail. In Fig. 2.19, the structure of the rating criteria is explained for Q_H1.1.1.1 as an example.



Part II Q_H1 Comfortable, Healthy and Safe Indoor Environment   CASBEE for Home (Detached House)

1 Heating and Cooling

1.1 Basic performance

1.1.1 Ensuring thermal insulation and airtightness performance

■ Assessment Item

Evaluate the basic thermal performance of the building to ensure the comfort of occupants based on its ability to control the inflow and outflow of outdoor heat. The assessment criteria are the same as those listed in "LR_H1.1.1 Control of thermal load of building."

■ Assessment Level

Level	Criterion
Level 1	The building satisfies the requirements of Grade 1 in Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards.
Level 2	The building satisfies the requirements of Grade 2 in Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards.
Level 3	The building satisfies the requirements of Grade 3 in Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards.
Level 4	(No corresponding level)
Level 5	The building satisfies the requirements of Grade 4 in Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

The building's performance is evaluated in terms of heat insulation and airtightness, which are regarded as basic functions to avoid summer heat and winter cold in its rooms.

The assessment criteria are in accordance with Section 5-1, "Energy-Saving Action Grades," in the Evaluation Method Standards of the Japan Housing Performance Indication Standards, as defined by the Housing Quality Assurance Act, using any of the following measurements specified for each thermal insulation area zone:
1) Year-round heating and cooling load
2) Thermal loss coefficient, etc.
3) Heat transmission coefficient, etc.

See the Evaluation Method Standards of the Japan Housing Performance Indication Standards for specific values and calculation methods. Further details regarding the calculation are provided in the "Guide to Energy-Saving Standards for Houses" by the Institute for Building Environment and Energy Conservation (IBEC). The thermal insulation area zone classifications are described in Part III, Section 3.2, "Reference Materials for Assessment."

(Reference) Section 5-1, "Energy-Saving Action Grades" of the Japan Housing Performance Indication Standards

Energy-Saving Action Grade	Extent of actions, such as thermal insulation, to reduce energy used for heating and/or cooling
Grade 4	Measures are taken to reduce energy use to a significant degree (to the extent of meeting the "Judgment Criteria for Building Owners for Energy Efficiency Standards").
Grade 3	Measures are taken to reduce energy use to a certain degree.
Grade 2	Measures are taken to reduce energy use to a small degree.
Grade 1	Other than the above

Fig. 2.19 Structure of rating criteria for Q_H1.1.1.1

1 Heating and Cooling

1.1 Basic performance

1.1.1 Ensuring thermal insulation and airtightness performance

■ Assessment Item

Evaluate the basic thermal performance of the building to ensure the comfort of occupants based on its ability to control the inflow and outflow of outdoor heat. The assessment criteria are the same as those listed in "LR$_H$1.1.1 Control of thermal load of building."

■ Assessment Level

Level	Criterion
Level 1	The building satisfies the requirements of Grade 1 in Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards.
Level 2	The building satisfies the requirements of Grade 2 in Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards.
Level 3	The building satisfies the requirements of Grade 3 in Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards.
Level 4	(No corresponding level)
Level 5	The building satisfies the requirements of Grade 4 in Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

The building's performance is evaluated in terms of heat insulation and airtightness, which are regarded as basic functions to avoid summer heat and winter cold in its rooms.

The assessment criteria are in accordance with Section 5-1, "Energy-Saving Action Grades," in the Evaluation Method Standards of the Japan Housing Performance Indication Standards, as defined by the Housing Quality Assurance Act, using any of the following measurements specified for each thermal insulation area zone:

1) Year-round heating and cooling load
2) Thermal loss coefficient, etc.
3) Heat transmission coefficient, etc.

See the Evaluation Method Standards of the Japan Housing Performance Indication Standards for specific values and calculation methods. Further details regarding the calculation are provided in the "Guide to Energy-Saving Standards for Houses" by the Institute for Building Environment and Energy Conservation (IBEC). The thermal insulation area zone classifications are described in Part III, Section 3.2, "Reference Materials for Assessment."

(Reference) Section 5-1, "Energy-Saving Action Grades" of the Japan Housing Performance Indication Standards

Energy-Saving Action Grade	Extent of actions, such as thermal insulation, to reduce energy used for heating and/or cooling
Grade 4	Measures are taken to reduce energy use to a significant degree (to the extent of meeting the “Judgment Criteria for Building Owners for Energy Efficiency Standards”).
Grade 3	Measures are taken to reduce energy use to a certain degree.
Grade 2	Measures are taken to reduce energy use to a small degree.
Grade 1	Other than the above

1.1.2 Sunlight adjustment capability

■ Assessment Item

Evaluate the design of openings that block solar radiation during summer and capture it during winter based on the sunlight penetration ratio.

■ Assessment Level

Level	Criterion
Level 1	The building does not satisfy the criterion of Level 3.
Level 2	(No corresponding level)
Level 3	The building can reduce the sunlight penetration ratio in the subject openings to 0.60 or less in the summer.
Level 4	The building can reduce the sunlight penetration ratio in the subject openings to 0.45 or less in the summer.
Level 5	The building can reduce the sunlight penetration ratio in the subject openings to 0.30 or less in the summer and 0.6 or more in the winter.

Availability of conditions for adding points:
*None

Level change according to conditions:
*When no sunlight is expected to enter during winter due to the shade of buildings located off the property concerned or features of the terrain, the evaluation can be made based solely on the summer sunlight penetration ratio in Level 5.

Assessment not applicable:
*Any house situated in a place where almost no sunlight is expected to enter throughout the year.

■ Description

In addition to the performance of heat insulation and airtightness in the previous section, the building's ability to control the penetration of sunlight through openings is evaluated in this section, as one of its basic functions to ensure a comfortable thermal environment throughout the year.

The openings subject to evaluation are those made in the exterior walls facing east, south, and west (within ± 150 degrees of south) of the major living rooms (an integrated space including the main living room, and the main bedroom) and those made in the roof.

The sunlight penetration ratio may be calculated not only for windows but also for different combinations of solar shading materials, such as curtains and blinds, as well as eaves, overhangs, etc., which can be changed according to winter and summer conditions. While windows must always be evaluated in principle, such solar shading materials, eaves, and overhangs that do not block sunlight during the winter season may be exempted from the calculation of the winter sunlight penetration ratio.

The sunlight penetration ratio can be obtained by the method specified in the JIS R3106 Japanese Industrial Standard or the method provided in the "Guide to Energy-Saving Standards for Houses" by IBEC. It may also be calculated using a simplified method, explained below.

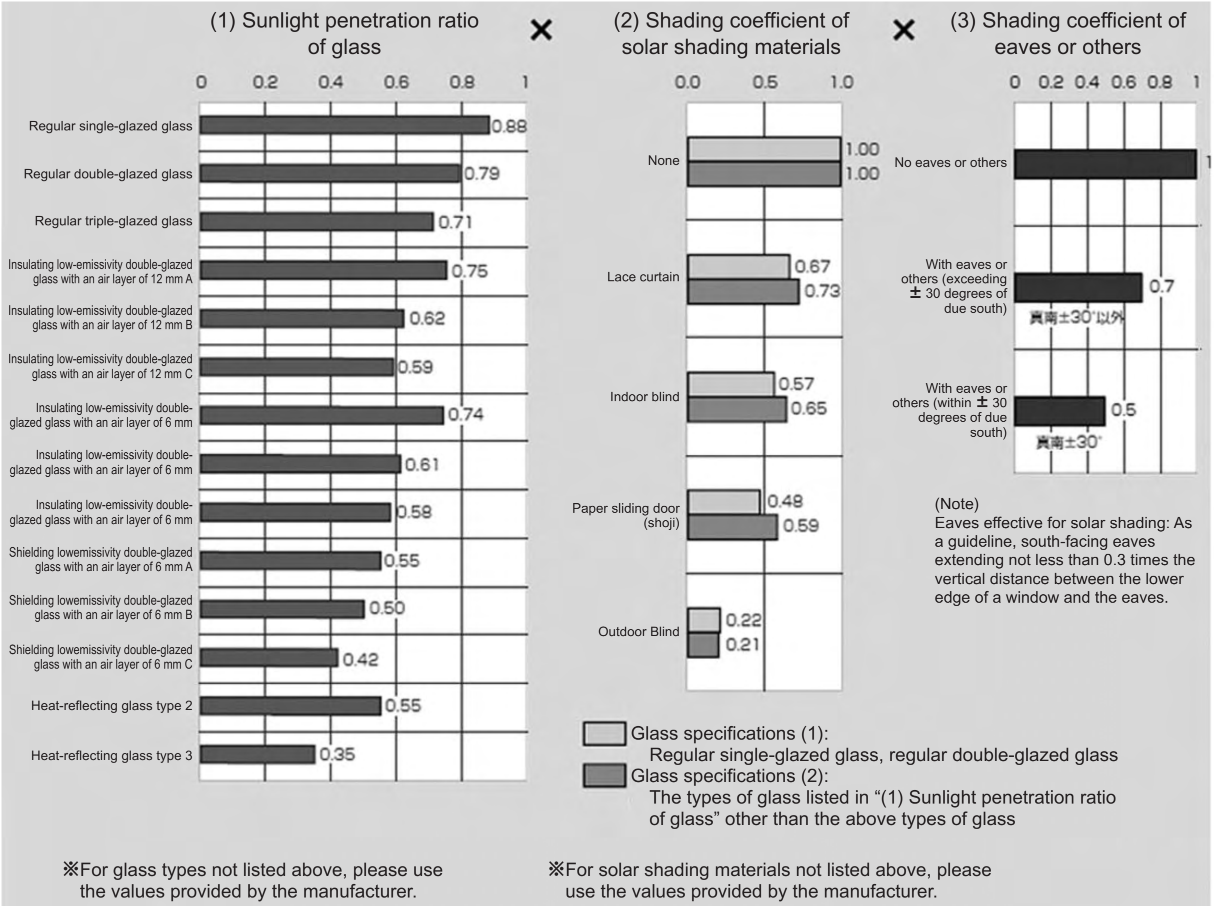
Simplified Calculation of Sunlight Penetration Ratio

From the column "Simplified method of calculating sunlight penetration ratio for openings" (page 137) in Section 4.2.2, "Target Energy-Saving Levels for Solar Shading," of the "Design Guidelines for Self-Cycling Residences" by IBEC:

(Equation)

Sunlight penetration ratio = Sunlight penetration ratio of glass × Shading coefficient of solar shading materials × Shading coefficient of eaves or others.

(See the figure below for the values required for the calculation.)



Source: ”Design Guidelines for Self-Cycling Residences” by IBEC (page 137)

2

When different sunlight penetration ratios are yielded due to different openings in the same room, a weighted average of the sunlight penetration ratios of all the openings based on the opening surface area should be applied to the evaluation. The criterion should be met in both the integrated space including the main living room and the main bedroom.

Deciduous trees that create shade over almost the entire surface of the target opening during the summer may be included in the calculation as an element of solar shading equivalent to eaves.

■ Explanation of Terminology

Sunlight penetration ratio:

The ratio of the amount of sunlight penetrating into the room to the amount of incident solar radiation. "Sunlight penetration ratio" is equivalent in definition to "solar heat gain coefficient." According to JIS R3106, "Testing method on transmittance, reflectance and emittance of flat glasses and evaluation of solar heat gain coefficient," the solar heat gain coefficient is defined as the ratio of the sum of the solar radiation flux that penetrates the glass part and the heat flux absorbed by the glass and transmitted to the inside to the incident solar radiation flux with respect to the solar radiation perpendicularly incident to the window glass surface.

1.2 Preventing summer heat

1.2.1 Allowing breezes in and heat out

■ Assessment Item

Evaluate the design of the house for taking in outdoor air and removing heat built up in the rooms to the outside.

■ Assessment Level

Level	Criterion
Level 1	The building does not satisfy the criterion of Level 3.
Level 2	(No corresponding level)
Level 3	The building has openings in two directions in major rooms or has an opening in one direction and is designed to promote ventilation and heat removal.
Level 4	(No corresponding level)
Level 5	The building has openings in two directions in all rooms or has an opening in one direction and is designed to promote ventilation and heat removal.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

Check whether the room has openings in two different directions or is designed to facilitate ventilation and heat removal even if it has an opening or openings in one direction only. The house should be rated as Level 3 if such an arrangement is made in the major living rooms (an integrated space including the main living room, and the main bedroom), or Level 5 if in all living rooms.

The term "an opening or openings in one direction" refers to the case where the living room concerned has one or more openings in one direction only, and the term "openings in two different directions" refers to the case of two or more directions.

While there are various ways to facilitate ventilation and heat removal, such as clerestory windows, openable skylights, and wind catchers, careful planning is necessary in order to obtain substantial effects after fully considering the site conditions, including the direction of the prevailing wind and the density of buildings. Special consideration can be given to the location of doors between rooms, or the setting of transoms, in order to secure paths for ventilation and heat exhaust throughout the building.

See Section 3.1.4, "How to Utilize Natural Wind," in the "Design Guidelines for Self-Cycling Residences" by IBEC, in reference to specific arrangements for ventilation and heat exhaust.

1.2.2 Proper planning for cooling

■ Assessment Item

Evaluate whether cooling is properly planned in the major living rooms.

■ Assessment Level

Level	Criterion
Level 1	The building does not specifically consider a cooling plan in major rooms.
Level 2	(No corresponding level)
Level 3	The building considers an appropriate cooling plan in an integrated space including the living room.
Level 4	(No corresponding level)
Level 5	The building considers an appropriate cooling plan in major rooms.

Availability of conditions for adding points:
*None

Level change according to conditions:
*Even if there is no plan to install a cooling system, the house concerned should be rated as Level 3 if a certain arrangement is made to prevent uneven temperature distribution; e.g., the use of a ceiling fan.

Assessment not applicable:
*The house should be excluded from assessment if its major living rooms are considered to be able to maintain a comfortable thermal environment even without a cooling system and the cooling of these rooms is not planned at all; provided, however, that these rooms are not equipped with dedicated electrical outlets for an air-conditioning system.

■ Description

The term "major living rooms" refers to an "integrated space including the main living room" and the "main bedroom," and must be assessed if a dedicated power outlet for an air conditioner is installed in the room, even if the installation of a cooling system is not planned. The following standards are to be used when assessing a room with respect to proper planning for cooling:

Level 3: The cooling of an integrated space including the main living room is properly planned. As the requirements for proper planning, the following items ① and ② should both be satisfied:

① A cooling system of the appropriate capacity to cool the entire living room is selected according to the size, thermal insulation performance, and airtightness of the room.

Guideline for selecting a room air conditioner of the appropriate capacity:
The catalog and description of an air conditioner usually specify a room size according to the machine's cooling capacity. If there is a range of room sizes, the smallest number typically represents a south-facing room in a Japanese-style wooden residence, and the largest number a south-facing room in an apartment block made of reinforced concrete.

*For example, if the description says "cooling capacity of 2.2 kW (6-9 *jou* [tatami mats])," "6 *jou*" represents the size of a south-facing room in a Japanese-style wooden residence and "9 *jou*" that of a south-facing room in a reinforced-concrete apartment block.

2.2 kW (6-9 *jou*)	2.5 kW (7-10 *jou*)	2.8 kW (8-12 *jou*)	3.62 kW (10-15 *jou*)	4.0 kW (11-17 *jou*)

For houses rated as Level 3 or Level 5 in "Q$_H$1.1.1.1 Ensuring thermal insulation and airtightness performance" in particular, a cooling system should be selected within the limits of the figures above, and an air conditioner of excessive cooling capacity relative to the room size should be avoided.

② The cooling system is installed where there are no obstacles in the path of the air discharge and intake.

2

Level 5: The same requirements as for Level 3; i.e., ① and ②, are fulfilled not only in the integrated space including the main living room but also in the main bedroom, or a whole-house air-conditioning system is installed to cool and heat the entire house.

The devices subject to evaluation in "LR_H1.2.1.2 Cooling system" should be the same as those evaluated as a cooling system for the "integrated space including the main living room" in this section.

The use of cooling equipment other than an air conditioner can be considered as proper planning for cooling if it satisfies the following conditions.

*Conditions for the use of cooling equipment other than an air conditioner:

- it is unlikely to create temperature variations within the room; and
- it can control temperature in the activity area of the applicable living room.

(Reference) Proper Location for a Room Air Conditioner

The indoor unit of a room air conditioner should be installed in accordance with the instructions in the manufacturer's brochures, technical information, etc.; in addition, it is preferable for it to be installed at a location that will be unlikely to create temperature variations in the room, keeping the following points in mind:

- The indoor unit should be installed where there are no obstacles in the path of the air discharge and intake.
- The indoor unit should be installed on a short-side wall in the case of a rectangular room.
- The indoor unit should be installed at or near the center of a wall in the case of a square room.
- The indoor unit should be installed near a window.
- The indoor unit should be installed so that its wind (cool or warm) will not directly hit people, especially in a bedroom, etc.
- Consideration should be given to installing more than one unit as appropriate in the case of a large or L-shaped room.

The outdoor unit of a room air conditioner should be installed in accordance with the instructions in the manufacturer's brochures, technical information, etc.; in addition, it is preferable for it to be installed keeping the following points in mind:

- The outdoor unit should be installed so as to maintain a proper distance from surrounding objects so that it will not short-circuit.
- The outdoor unit should be installed where it is unlikely to be exposed to direct sunlight.

1.3 Preventing winter cold

1.3.1 Proper planning for heating

■ Assessment Item

Evaluate whether heating is properly planned in the major living rooms.

■ Assessment Level

Level	Criterion
Level 1	The building does not specifically consider a heating plan in major rooms.
Level 2	(No corresponding level)
Level 3	The building considers an appropriate heating plan in an integrated space including the living room.
Level 4	(No corresponding level)
Level 5	The building considers an appropriate heating plan in major rooms.

Availability of conditions for adding points:
*None

Level change according to conditions:
*Even if there is no plan to install a heating system, the house is to be rated as Level 3 if a certain arrangement is made to prevent uneven temperature distribution, including the use of a ceiling fan.

Assessment not applicable:
*A residence is to be excluded from assessment if its major living rooms are considered to be capable of maintaining a comfortable thermal environment even without a heating system and the heating of these rooms is not planned at all.

■ Description

In this assessment, "proper planning for heating" means planning for a heating system that realizes uniform temperature distribution throughout the room and a thermal environment with little air current. As a guideline for determining the appropriateness of such planning, "selection of heating capacity" and "installation location" are adopted in the assessment (see "Guidelines for Determining the Adequacy of Heating Planning" below).

The heating devices subject to this evaluation are those that can be used as a primary heater during stationary operation; such heaters as *kotatsu* (a table with an electric heater) and halogen heaters are not to be included.

The term "major living rooms" refers to an "integrated space including the main living room" and the "main bedroom." The house should be rated as Level 3 if heating is properly planned in the integrated space including the main living room, or as Level 5 if such a plan is designed in major living rooms including the main bedroom. The house should be also rated as Level 5 if a whole-house air-conditioning system is in place.

A house should be evaluated as Level 1 if any of the following holds true:
a. A heater that discharges exhaust fumes inside the room is used,
b. A heater is placed where there is an obstacle in the path of the air discharge and/or intake, or
c. The building does not satisfy the criterion of Level 3.

Guidelines for Determining the Adequacy of Heating Planning

The following are guidelines for proper planning of the main heating devices:

1. Air Conditioner

Item	Guidelines
Selection of Heating Capacity	An air conditioner of the appropriate capacity to heat the entire living room is selected according to the size, thermal insulation performance, and airtightness of the room. • Since the heating capacity surpasses the cooling capacity in any type of air conditioner, an air conditioner is considered to have the required level of heating capacity if it is selected according to the standards in “Q1.1.2.2 Proper planning for cooling.” It should be noted that an air conditioner selected based on the heating load may not have sufficient cooling capacity. • It should be noted that, if there is a large stairwell or there are large window surfaces, an air conditioner may lack sufficient heating capacity even if selected according to the

	above standards.
Consideration of Installation Location	See "(Reference) Proper Location for a Room Air Conditioner" in "Q_H1.1.2.2 Proper planning for cooling."

2. FF Heater, Semi-hermetic Heater

Item	Guidelines
Selection of Heating Capacity	A heater having a capacity equal to or greater than the maximum heating load of the target living room should be selected. However, the device should not have an excessive heating capacity. • The maximum heating load can be calculated individually, or by using the values in the table below. • It should be noted that the heating capacity may not be sufficient if the assumptions made for calculation of the values below significantly differ from the attributes of the living room (e.g., Thermal Insulation Area Zones I & II under Energy-Saving Standards*, stairwell, etc).
Consideration of Installation Location	① The space in front of the device should be clear of obstacles. ② The device should be installed under the window in the case of a *koshimado* (a window from waist height up) or next to the window in the case of a *hakidashimado* (a window from the floor up) if cold drafts are a concern around the opening. ③ In the case of a snowy region, the device should be installed so that the outdoor air intake/discharge part of the device will not be covered with snow.

(Reference) Guidelines for Maximum Heating Load in Thermal Insulation Area Zones III and IV* under Energy-Saving Standards (W/m^2):

Insulated Envelope	Window Surface Area	Upstairs	Maximum Heating Load	
			Zone III	Zone IV
High	Small	Roof	166	153
		Room	144	133
	Large	Roof	184	170
		Room	160	148
Medium	Small	Roof	207	191
		Room	180	167
	Large	Roof	230	213
		Room	200	185
Low	Small	Roof	290	268
		Room	252	233
	Large	Roof	322	298
		Room	280	259

Values calculated based on the SHASE S112-2000 (formerly HASS 112-2000) standards established by The Society of Heating, Air-Conditioning and Sanitary Engineers of Japan.

Calculation assumptions	Insulated envelope:	High:	Double-glazed glass, ceiling/wall/floor glass wool 100 mm
		Medium:	Single-glazed glass, ceiling/wall/floor glass wool 50 mm
		Low:	Single-glazed glass, no ceiling/wall/floor glass wool
	Windows:	Small:	1,800 mm x 900 mm
		Large:	1,800 mm x 1,800 mm
	Upstairs:	Roof:	There is no room but only the roof above the living room concerned.
		Room:	There is a room above the living room concerned.
	Room temperature:	20 degrees Celsius.	

* Thermal Insulation Area Zones under Energy-Saving Standards: See Part III, Section 3.2, "Reference Materials for Assessment (Reference 1)."

3. Floor Heating

Floor heating should be installed in a way that ensures uniform temperature distribution within the living room concerned and with consideration for the user's activity patterns. The key points are as follows:

Item	Guidelines
Selection of Heating Capacity	① The installed floor heating should cover approximately 60% or more of the floor area of the living rooms (inside dimensions). In this case, the projecting areas of fixtures that extend from floor to ceiling (e.g., closet, system kitchen) should be excluded from the floor area of these living rooms. ② When the main living room, which is one of the major living rooms, joins the kitchen or other spaces to form an integrated space, it is desirable to also install floor heating in the kitchen or other spaces. Otherwise, the area of the main living room covered by the floor heating should be maximized to approximately 70% or more. • It should be noted that, if there is a large stairwell or there are large window surfaces, the floor heating may lack sufficient heating capacity even if selected according to the above standards.
Consideration of Installation Location	① Floor heating should be installed near windows to prevent cold drafts. ② Floor heating should be installed in consideration of daily activity areas and in-house-mobility.

4. Radiator

Item	Guidelines
Selection of Heating Capacity	In the same way as for FF and semi-hermetic heaters.
Consideration of Installation Location	The radiator should be installed near a window (e.g., under a *koshimado*) to prevent cold drafts.

The devices subject to evaluation in "LR_H1.2.1.1 Heating system" should be the same as those evaluated as a heating system for an "integrated space including the main living room" in this section.

2 Health, Safety, and Security

2.1 Countermeasures against chemical contaminants

■ Assessment Item

Evaluate whether adequate measures are taken to avoid indoor air pollution from chemical contaminants.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	The building satisfies the requirements of Grade 1 in Section 6-1, "Countermeasures against Formaldehyde (Interior, Ceiling Plenum, etc.)," of the Japan Housing Performance Indication Standards.
Level 4	The building satisfies the requirements of Grade 2 in Section 6-1, " Countermeasures against Formaldehyde (Interior, Ceiling Plenum, etc.)," of the Japan Housing Performance Indication Standards.
Level 5	The building satisfies the requirements of Grade 3 in Section 6-1, " Countermeasures against Formaldehyde (Interior, Ceiling Plenum, etc.)," of the Japan Housing Performance Indication Standards.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

Houses are to be evaluated based on Section 6-1, "Countermeasures against Formaldehyde (Interior, Ceiling Plenum, etc.)," of the Japan Housing Performance Indication Standards. The areas to be evaluated include interior finish (except pillars or other axis materials, crown moldings, window sills, skirtings, fitted framing, paints used partially, and adhesives) and base materials used in the ceiling plenum or other spaces (except in cases where certain arrangements such as ventilation are made there). The scope of this evaluation is the entire house.

(Reference) Section 6-1, "Countermeasures against Formaldehyde (Interior, Ceiling Plenum, etc.)," of the Japan Housing Performance Indication Standards

Formaldehyde Emission Grade	Formaldehyde emissions from specified building materials used for the finish of the interior furnishings of living rooms or for the base of the ceiling plenum or other spaces that have no ventilation system
Grade 3	Formaldehyde emissions are extremely low (equivalent to F☆☆☆☆ or higher in the Japanese Industrial Standards or Japanese Agricultural Standards).
Grade 2	Formaldehyde emissions are low (equivalent to F☆☆☆ or higher in the Japanese Industrial Standards or Japanese Agricultural Standards).
Grade 1	Other than the above

2.2 Proper planning for ventilation

■ Assessment Item

Evaluate whether any arrangements are made to ensure that indoor-generated pollutants are properly removed by ventilation or other methods.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	The building does not satisfy the criterion of Level 3.
Level 3	The building considers appropriate plans, such as ventilation, to take care of pollutants generated in the kitchen, toilet, or bathroom.
Level 4	(No corresponding level)
Level 5	The building satisfies the criterion of Level 3 and is also designed to ensure the required ventilation for each room.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

Level 3 evaluates whether polluted air generated in the kitchen, toilet, or bathroom flows into living rooms. It also evaluates whether local ventilation is designed in such rooms where pollutants are generated so as to prevent the front door from being affected by unwanted force when it is opened or closed due to an excessive differential pressure between the interior and exterior caused by ventilation systems, and so as not to cause the backflow of exhaust fumes from semi-hermetic burning appliances. Particularly in the kitchen, where return air is exhausted in large volume, it is desirable to use a ventilating fan that simultaneously supplies and discharges air or to install an air-supply inlet that opens as the ventilator starts. A room will also meet the criterion of Level 3 if it has a window to allow necessary local ventilation. Guidelines on the volumes of local ventilation are provided in the table below.

2

Table Guidelines on Volumes of Local Ventilation (See "Guide to Energy-saving Standards for Houses" by IBEC.)

Room	Guideline on Volume of Ventilation
Kitchen Gas Heat Source (with Hood)	The greater of 30 KQ or 300 m^3/h (K: theoretical amount of exhaust gas, Q: amount of fuel consumption)
Kitchen Electricity	300 m^3/h
Bathroom	100 m^3/h
Washroom	60 m^3/h
Toilet	40 m^3/h
Laundry	60 m^3/h

The criterion of Level 5 is met if the required volume of ventilation is ensured for individual rooms, rather than for the whole residence. It requires that the air volume be calculated or actually measured after construction, or that the house be designed based on the "Rules for Ensuring the Required Volume of Ventilation."

Even if the volume of ventilation meets the requirements of the Building Standards Act for the whole building, certain areas of the house might have stale air due to inadequate airflow paths. This section therefore requires ventilation to maintain the air quality of individual living rooms. It does not necessarily require outdoor air to be delivered directly into the room, but does require a supply of air whose pollutant concentration is sufficiently below the acceptable contaminant levels so that it can dilute pollutants generated in each room to below the required levels.

The use of a duct requires caution as air volume is greatly affected by the effects of pressure loss. Refer to Chapter 7 of the "Guide to Energy-saving Standards for Houses" by IBEC for specific information on methods of ventilation in general.

2.3 Precautions against crime

■ Assessment Item

Openings are evaluated for measures to prevent intrusions.

■ Assessment Level

Level	Criterion
Level 1	No particular measures taken.
Level 2	(No corresponding level)
Level 3	With regard to openings of a size that would allow intrusion, some measures against intrusion have been taken for the entrance to the building and for other openings whose lower edge is a distance of 2 m or less from ground level.
Level 4	With regard to openings of a size that would allow intrusion, effective measures to prevent intrusion have been taken for the entrance to the building and for other openings whose lower edge is a distance of 2 m or less from ground level.
Level 5	The building satisfies the criterion of Level 4 and, in addition, with regard to openings of a size that would allow intrusion, effective measures to prevent intrusion have been taken for openings whose lower edge is a distance of 2 m or less from a balcony, etc. and that are 0.9 m or less in lateral distance from a balcony, etc.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

Fundamentally, the security level should be evaluated on the whole by taking into account exterior arrangements (monitorability), such as fences and hedges, or security systems, but the assessment criteria specified in Section 10-1, "Intrusion Prevention Arrangements for Openings," of the Japan Housing Performance Indication Standards, are applied for the time being.

These standards require that, for detached houses, every opening that is large enough to allow intrusions and corresponds to categories a, b, or c below be designed in a way that can effectively prevent intrusions:

a. An opening used as an entrance and exit of the house;
b. An opening whose lower edge is a distance of 2 meters or less from ground level, or whose lower edge is a distance of 2 meters or less from a balcony, etc. and that is 0.9 meters or less in lateral distance from a balcony etc. (except the case of an opening corresponding to category a above); or
c. Any opening other than those listed in categories a and b above.

Here, Level 3 requires that "some measures against intrusion" be taken, such as the installation of two locks in different places, for the openings listed in category a as well as openings closer to the ground among those listed in category b. Level 4 requires that "effective measures to prevent intrusion" be taken for the same openings as in Level 3. Level 5 requires "effective measures to prevent intrusion" for the openings listed in category a as well as all of the openings listed in category b.

Table Openings with effective measures to prevent intrusion

	(A)	(B)
(1)	Any openings that are designed to open and close and are used as an entrance and exit of the house	i Doors and locks that correspond to either a or b below are used: a. Any doors that are confirmed to have a function to prevent intrusions (for doors that allow the passage of a block whose cross-sectional dimensions correspond to a, b, or c in the “openings of a size that would allow intrusion” specified below, only those that use glass confirmed to have a function to prevent intrusions

		[including glass that is confirmed to have a function to prevent intrusions with the use of window film]) and are equipped with two or more locks. In this case, one or more of these locks should be confirmed to have a function to prevent intrusions and to be equipped with a sickle-shaped deadbolt. In addition, one or more of these locks should be designed to make it impossible for an intruder to manipulate the thumbturn even by making a hole in the door and extending an arm inside. b. Any other doors and locks that are confirmed to have the same capability as those listed in a. ii *Amado* (storm doors), shutters, or other types of window panes that are confirmed to have a function to prevent intrusions are in place.
(2)	Any openings that are designed to open and close and are not used as an entrance or exit of the house	i Sashes confirmed to have a function to prevent intrusions (only those with two or more crescent locks or others) and glass (including glass that is confirmed to have a function to prevent intrusions with the use of window film) are used. ii Measures specified in (1) i above are in place. iii *Amado* (storm doors), shutters, gratings, or other types of window panes that are confirmed to have a function to prevent intrusions are in place.
(3)	Any openings that are not designed to open and close	i Glass confirmed to have a function to prevent intrusions (including glass that is confirmed to have a function to prevent intrusions with the use of window film) is used ii *Amado* (storm doors), shutters, gratings, or other types of window panes that are confirmed to have a system to prevent intrusions are in place.

2

■ Explanation of Terminology

Openings of a size that would allow intrusion:

Any openings leading into the inside of the house that allow one of the blocks whose cross-sectional dimensions are listed in a to c below to pass through:

a. A rectangle measuring 400 mm on the long side and 250 mm on the short side,
b. An ellipse measuring 400 mm on the major axis and 300 mm on the minor axis, or
c. A circle measuring 350 mm in diameter.

Effective measures to prevent intrusion:

The measures are specified in column (B) of the above table, according to the opening type listed in (A) of the same table. The components in (B) can be interpreted as CP-marked building components set forth by the "Joint Public-Private Convention."

Some measures against intrusion:

Any measures considered somewhat effective to prevent crime, such as the installation of two regular locks, even though they do not correspond to "effective measures to prevent intrusion" above.

CP Components:

The CP (crime prevention) mark has been established by the Joint Public-Private Convention to promote the use of crime-prevention building components, and can be used by manufacturers, etc. of the listed products. The latest versions of the lists are available on the Japan Crime Prevention Association's website (http://cp-bohan.jp/).

The Center for Better Living provides on its website a database that contains pictures, features, and other information on the listed products (http://www.blhp.org/labo/bohan/).

3 Brightness

3.1 Use of daylight

■ Assessment Item

Evaluate structural arrangements to direct sunlight into the rooms based on the window opening ratio, window direction, and presence of daylight utilization facilities.

■ Assessment Level

Level	Criterion
Level 1	Simple opening ratio: Less than 15%
Level 2	Simple opening ratio: 15% or more and less than 20%
Level 3	Simple opening ratio: 20% or more
Level 4	(May be selected if the Conditions for adding points are met.)
Level 5	(May be selected if the Conditions for adding points are met.)

Availability of conditions for adding points:
*Available
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

In principle, a larger window area in a living room is considered better. Active utilization of daylight in "an integrated space including the living room" and "bedrooms" in particular are rated highly. If there are other living rooms that are used for an extended period of time, however, the bedrooms may be replaced with such living rooms in the assessment.

Conditions for adding points

In the evaluation using the simple opening ratio, ratings can be raised by up to two levels if the following conditions are met:

1. The building maintains, in an integrated space including the living room, the effective daylight-receiving area specified by the Building Standards Act as a window on the southern side or a skylight or has a daylight utilization system installed.
2. The building maintains, in the bedrooms, the effective daylight-receiving area specified by the Building Standards Act as a window on the southern side or a skylight or has a daylight utilization system installed.

"A window on the southern side" in the Conditions for adding points includes windows inclined within ±45 degrees of south. "A daylight utilization system" is an apparatus that captures (gathers) light, or directs light into the back of the room, such as light shelves, light ducts, or condensers.

Method of Calculating Simple Opening Ratio

Calculation of the simple opening ratio is pursuant to Section 7-1, "Simple Opening Ratio," of the Japan Housing Performance Indication Standards:

$W = A / S \times 100$,

where

W is the opening ratio (in %),
A is the sum of the area of the openings in the living rooms of the target house (only the openings that face the outside and can be opened, or are made of light-permeable materials) (in m^2), and
S is the sum of the floor areas of the living rooms (in m^2).

4 Quietness

■ Assessment Item

Evaluate whether quietness in the rooms is assured on the basis of the performance of sound insulation against outdoor noise, etc.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	The building is designed to have openings in the exterior walls equivalent to Grade 1 in Section 8-4, "Transmission Loss Grades (Exterior Wall Openings)," of the Japan Housing Performance Indication Standards.
Level 4	The building is designed to have openings in the exterior walls equivalent to Grade 2 in Section 8-4, "Transmission Loss Grades (Exterior Wall Openings)," of the Japan Housing Performance Indication Standards.
Level 5	The building is designed to have openings in the exterior walls equivalent to Grade 3 in Section 8-4, "Transmission Loss Grades (Exterior Wall Openings)," of the Japan Housing Performance Indication Standards.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

The evaluation is conducted according to Section 8-4, "Transmission Loss Grades (Exterior Wall Openings)," of the Japan Housing Performance Indication Standards.

This section assesses sound insulation performance against outdoor noise, etc. based on impermeability to airborne sound. Primarily, this should be evaluated by taking various given conditions into account, such as the locations of ventilation outlets or noise sources. Here, however, the performances of sashes and door sets that are considered highly influential are used for convenience.

The subjects of the evaluation are the sashes and door sets having the lowest performance of all the sashes and door sets built on the exterior walls of living rooms.

Sound insulation levels can be obtained from the manufacturers. If they are not obtained, or a combination of sashes is to be evaluated, the results of measurements carried out by the method defined in the JIS A1416 Japanese Industrial Standard can be used.

■ Explanation of Terminology

Sound Transmission Loss $R_{m(1/3)}$:

Mean sound transmission loss values measured by third-octave band analysis, specified by the JIS A1419-1 Japanese Industrial Standard.

(Reference) Section 8-4, "Transmission Loss Grades (Exterior Wall Openings)," of the Japan Housing Performance Indication Standards

Transmission Loss Grades (Exterior Wall Openings)	Degree of airborne sound insulation of sashes used for the exterior wall openings of a living room in each direction
Grade 3	Particularly outstanding insulation performance is provided (equal to or higher than $R_{m(1/3)}$-25 in the Japanese Industrial Standards).
Grade 2	Outstanding insulation performance is provided (equal to or higher than $R_{m(1/3)}$-20 in the Japanese Industrial Standards).
Grade 1	Other than the above

1 Basic Life Performance

1.1 Building frames

■ Assessment Item

Evaluate the basic performance of the building frames in terms of assuring a longer service life based on the degree of measures required to extend the period up to when large-scale renovation, such as replacement of materials used in the building frames, becomes necessary.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	The building satisfies the requirements of Grade 1 in Section 3-1, "Deterioration Resistance Grades (Building Frames, etc.)," of the Japan Housing Performance Indication Standards.
Level 4	The building satisfies the requirements of Grade 2 in Section 3-1, "Deterioration Resistance Grades (Building Frames, etc.)," of the Japan Housing Performance Indication Standards.
Level 5	The building satisfies the requirements of Grade 3 in Section 3-1, "Deterioration Resistance Grades (Building Frames, etc.)," of the Japan Housing Performance Indication Standards.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

The scoring criteria are based on Section 3-1, "Deterioration Resistance Grades (Building Frames, etc.)," of the Japan Housing Performance Indication Standards.

(Reference) Section 3-1, "Deterioration Resistance Grades (Building Frames, etc.)," of the Japan Housing Performance Indication Standards

Deterioration Resistance Grade (Building Frames, etc.)	Degree of measures required to extend the period up to when large-scale renovation, such as replacement of materials used in the building frames, becomes necessary.
Grade 3	Measures required to extend the period up to when large-scale renovation becomes necessary over three generations (about 75-90 years), under normally assumed natural conditions and maintenance, have been implemented.
Grade 2	Measures required to extend the period up to when large-scale renovation becomes necessary over two generations (about 50-60 years), under normally assumed natural conditions and maintenance, have been implemented.
Grade 1	Measures specified in the Building Standards Act have been implemented.

1.2 Exterior wall materials

■ Assessment Item

Evaluate the basic life performance of the base materials of exterior walls based on their years of durability and renewability.

■ Assessment Level

Level	Criterion
Level 1	A service life of less than 12 years can be expected.
Level 2	A service life of 12 years to less than 25 years can be expected.
Level 3	A service life of 25 years to less than 50 years can be expected.
Level 4	A service life of 50 years to less than 100 years can be expected.
Level 5	(May be selected if the Conditions for adding points are met.)

Availability of conditions for adding points:
*Available
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

The scoring criteria are based on the Century Housing System accreditation criteria, "Construction Methods (Ease of Maintenance)" (The Center for Better Living). The evaluation covers the base materials of exterior walls (or unpainted surface materials, such as tiles). The years of durability are determined by one of the following:

- Years of durability verified by accelerated deterioration tests, etc.
- Replacement period indicated on product catalogues, etc.
- Years of durability indicated in the table on the following page.

When multiple types of exterior wall materials have been used, the evaluation is based on the material that covers the largest area.

Note) Joint waterproofing, coatings, and paint are less durable than the base materials of exterior walls, but are excluded from evaluation on the assumption that they will be maintained appropriately.

Conditions for adding points:

The evaluation is raised one level when any of the following applies:

a) The building uses a structural or installation method that does not damage the building structure (or backing material) that is more durable than the exterior wall materials when exterior wall materials are replaced.

Examples: Exterior wall materials are set through a dry construction method without the use of mortar or adhesives (placement of tiles and siding boards using fixing brackets, ALC dry construction method).
Exterior wall materials are fixed using hook-type metal fixing brackets.

b) The building uses a structural or installation method that does not damage the exterior fittings that are as durable as the exterior wall materials when exterior wall materials are replaced.

Example: Window sashes do not have to be removed when replacing exterior wall materials.

c) The components making up the exterior wall materials are constituted in the form of units, so that renewal by the constituent unit is possible.

Examples: Exterior walls made of multiple panels, PC curtain wall

(Reference 1) List of Years of Durability of Exterior Wall Materials

Years of Durability	Type of Exterior Wall Material
50	Autoclaved lightweight concrete (ALC) board
60	Concrete block (type C, thickness: 100 mm)
100	Concrete (fair-faced concrete)
60	Granite (wet construction method)
60	Granite (dry construction method)
60	Teppeiseki stone (pyroxene andesite) (square tile)
40	Porcelain tile (floating method)
60	Porcelain tile (placing method)
40	Porcelain tile
30	Beaded clapboard
30	Vertical siding
15	Colored steel sheet (thickness: 1.0 mm)
40	Aluminum spandrel (thickness: 1.0 mm)
40	Fluororesin spandrel (thickness: 0.5 mm)
60	Stainless spandrel (thickness: 0.4 mm)
40	Aluminum panel (thickness: 1.0 mm)
60	Stressed panel (thickness: 0.8 mm)
30	Mortar with brushed finish (thickness: 25 mm)
30	Mortar with brushed finish (thickness: 30 mm)
30	Mortar with brushed finish (thickness: 35 mm)
30	Mortar with scratched lysine finish (white cement)
30	Mortar with scratched lysine finish
30	“DIA Lysine” (thickness: 25 mm including base)
30	Stucco (rough finish, thickness: 6-8 mm)
30	Acrylic lysine
30	Epoxy sprayed tile (mortar base)
15	Epoxy sprayed tile (concrete base)
30	Slate (small undulations, nailed)
30	Slate (small undulations, hook bolted)
30	Calcium silicate boards (thickness: 6 mm, metal joiner tapping screw)
30	Pearlite boards (thickness: 8 mm, nailed)
50	ALC panel (thickness: 125 mm)
50	Excelsior-cement panel D (thickness: 25 mm)
40	Siding
60	Formed cement board (thickness: 60 mm)
30	Extruded cement panel

Source: Manual for Building Life Cycle Energy Calculation Program (Building Research Institute Data No. 91), 1997

(Reference 2) Century Housing System Accreditation Criteria

Parts must have appropriate durability levels. Treatment methods (final treatment, recycling, reuse) at the disposal stage must be taken into account for parts with a short period of durability. The following durability levels are considered to be a measure of durability that integrates various types of durability such as physical durability and functional durability, as well as social durability.

Durability Levels:

Type 04	Expected period of durability: 3-6 years
Type 08	Expected period of durability: 6-12 years
Type 15	Expected period of durability: 12-25 years
Type 30	Expected period of durability: 25-50 years
Type 60	Expected period of durability: 50-100 years

Interfaces between parts and construction methods must correspond to differences in durability levels and conform with the following rules:

a) When renewing parts with new parts that are less durable than the remaining parts, the structure and fixing method of the new parts should be such that they will not damage the existing parts.

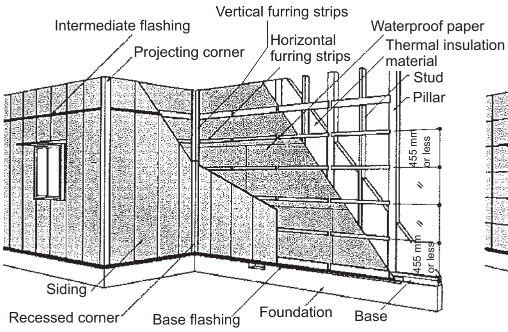
b) In the case of parts that have equal durability, their structure and fixing method should be such that they will not damage the existing parts when being renewed.

c) Parts that are composed of parts with the same level of durability should be structured in a way that allows the components to be renewed unit by unit. Parts that are composed of parts with different levels of durability should be structured in such a way that the replacement of less-durable parts (expendable parts) will not affect the other parts or the whole unit.

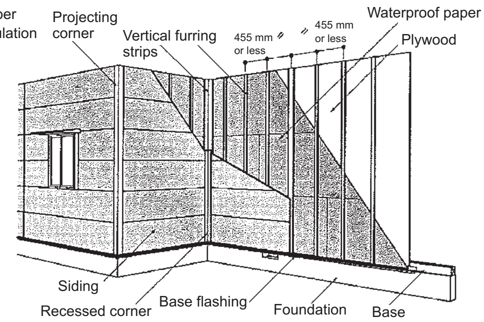
(Reference 3) Examples of Evaluation Cases

<u>Regular construction of a siding wall (timber framework method)</u>

→Level 3



Vertical siding, horizontal furring strips

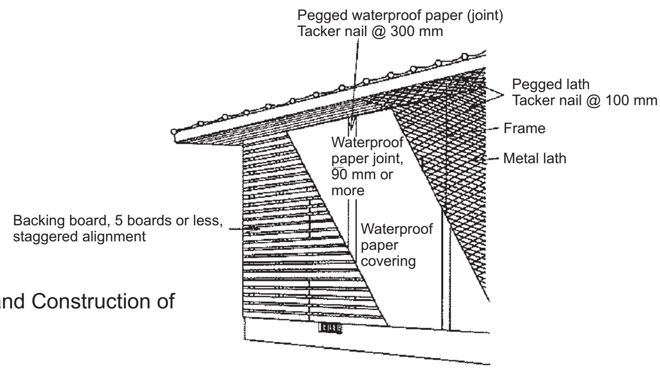


Horizontal siding, vertical furring strips

Reference: Ceramic Siding and Standard Construction
Published by the Japan Fiber Reinforced Cement Sidings Manufacturers Association

<u>Regular construction of a mortar wall (timber framework method)</u>

→Level 3



Reference: Technical Guide for Design and Construction of Wooden-Frame Houses
Published by the Mokujukyo Association

1.3 Roofing materials/flat roof

■ Assessment Item

Evaluate members and waterproofing materials of roofing materials and any flat roof based on their years of durability and renewability.

■ Assessment Level

Level	Criterion
Level 1	A service life of less than 12 years can be expected.
Level 2	A service life of 12 years to less than 25 years can be expected.
Level 3	A service life of 25 years to less than 50 years can be expected.
Level 4	A service life of 50 years to less than 100 years can be expected.
Level 5	(May be selected if the Conditions for adding points are met.)

Availability of conditions for adding points:
*Available
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

The scoring criteria are based on the Century Housing System accreditation criteria, "Construction Methods (Ease of Maintenance)" (The Center for Better Living). The subjects of evaluation are surface materials such as roofing; specifically, either "roofing materials" including roof tiles or slates, or a "waterproofing layer" such as sheet waterproofing or mortar waterproofing. The decision as to which of these is to be evaluated is made according to the following rules:

- If the roof is a sloped roof, as a rule it is evaluated in terms of the roofing materials.
- If the roof is a flat roof, as a rule it is evaluated in terms of the waterproofing layer.
- However, a flat roof is evaluated in terms of the roofing materials if the waterproofing layer is not exposed, as in the case of a folded-plate roof.
- A balcony mounted on top of the roofing materials by means of a trestle, etc. is evaluated in terms of the roofing materials.

In cases where the roofing materials are evaluated

The years of durability are determined by one of the following:

- Years of durability verified by accelerated deterioration tests, etc.
- Replacement period described in the product catalogue.
- Years of durability listed in "(Reference 1) List of Years of Durability of Roofing Materials."
- Performance in actual housing.

Whenever multiple types of roofing materials have been used, the material that covers the largest area is to be evaluated (excluding base materials, gutters, and steel plates).

Conditions for adding points:

The rating of the roofing materials will be raised by one level when either of the following conditions is met:

a) For replacement of roofing materials, a structure or installation method is used that does not damage the backing material (roof sheathing board) of higher durability than the roofing materials.
Examples: Roofing material has been fixed in place through a dry construction method without the use of clay or mortar. Roofing material has been fixed using hook-type metal brackets.

b) The components making up the roof are constituted in the form of units, so that renewal by the constituent unit is possible.
Example: Roofing material or folded-plate roof made of multiple panels

In cases where the waterproofing layer is evaluated

The years of durability are determined by one of the following:

- Years of durability verified by accelerated deterioration tests.

- Replacement period described in the product catalogue, etc.
- Years of durability listed in "(Reference 2) List of Years of Durability of Waterproofing Materials."

Conditions for adding points:
Satisfaction of the following conditions will raise the rating by up to two levels:

Part 1 Ease of replacement
The rating of waterproofing materials will be raised by one level when either of the following conditions is met:
a) For replacement of waterproofing materials, a structure or installation method is used that does not damage the exterior fittings such as sashes or doors of higher durability than the waterproofing material.
Example: The waterproofing material can be replaced without removing sashes or any other fixtures.
b) The components making up the waterproofing layer are constituted in the form of units, so that renewal by the constituent unit is possible.
Example: Waterproofing pan

Part 2 Deterioration mitigation treatment
The rating of waterproofing materials will be raised by one level when either of the following conditions is met:
a) Treatment has been carried out to mitigate deterioration of waterproofing materials.
Examples: Flashing or other finishing material acts as a solar insulation shield for the waterproofing material (e.g., finishing material for walking on has been set in place on the balcony).
An appropriate slope is provided to prevent water retention.
A design that enables the retention of drainage performance or appropriate maintenance has been planned (e.g., placement of nets to prevent clogging by dead leaves, a plan for removing leaves, etc.).
b) Appropriate treatment has been carried out for isolation of the waterproofing layer.
Examples: The waterproofing layer has been isolated from the building frame so as to be unaffected by vibration of the building frame.
The waterproofing layer has the resilience to absorb building frame vibration.
The joints of sheets have been welded or otherwise processed to prevent separation.

(Reference 1) List of Years of Durability of Roofing Materials

Years of Durability	Type of Exterior Wall Material
15	Colored steel sheet (flat roof)
15	Colored steel sheet (batten-seam roofing)
15	Colored steel sheet (folded-sheet roofing)
30	Fluororesin steel sheet (flat roof)
30	Fluororesin steel sheet (batten-seam roofing)
30	Fluororesin steel sheet
30	Fluororesin steel sheet (folded-sheet roofing)
30	Colored aluminum (flat roof)
30	Colored aluminum (batten-seam roofing)
30	Colored aluminum (folded-sheet roofing)
50	Colored (turncoat) stainless sheet (flat roof)
50	Colored (turncoat) stainless sheet (batten-seam roofing)
50	Colored (turncoat) stainless sheet (folded-sheet roofing)
60	Copper sheet (flat roof)
30	Colonial roofing
30	Colonial roofing (RC base)
30	Asphalt shingle roofing
30	Asphalt shingle roofing (RC base)
10	Vinyl chloride corrugated sheet
60	Japanese roof tiles (Western-style roof tiles)

Source: Manual for Building Life Cycle Energy Calculation Program (Building Research Institute Data No. 91), 1997

Note: Galvalium steel plates, which are not listed in the above table, are considered to have a durability almost equal to that of fluororesin steel plates.

(Reference 2) List of Years of Durability of Waterproofing Materials

Years of Durability	Type of Exterior Wall Material
30	Asphalt waterproofing (on a walkway)
15	Asphalt waterproofing (exposed)
15	Sheet waterproofing (on a walkway)
15	Sheet waterproofing (exposed)
15	Mortar waterproofing
10	Waterproof coating film

Source: Manual for Building Life Cycle Energy Calculation Program (Building Research Institute Data No. 91), 1997

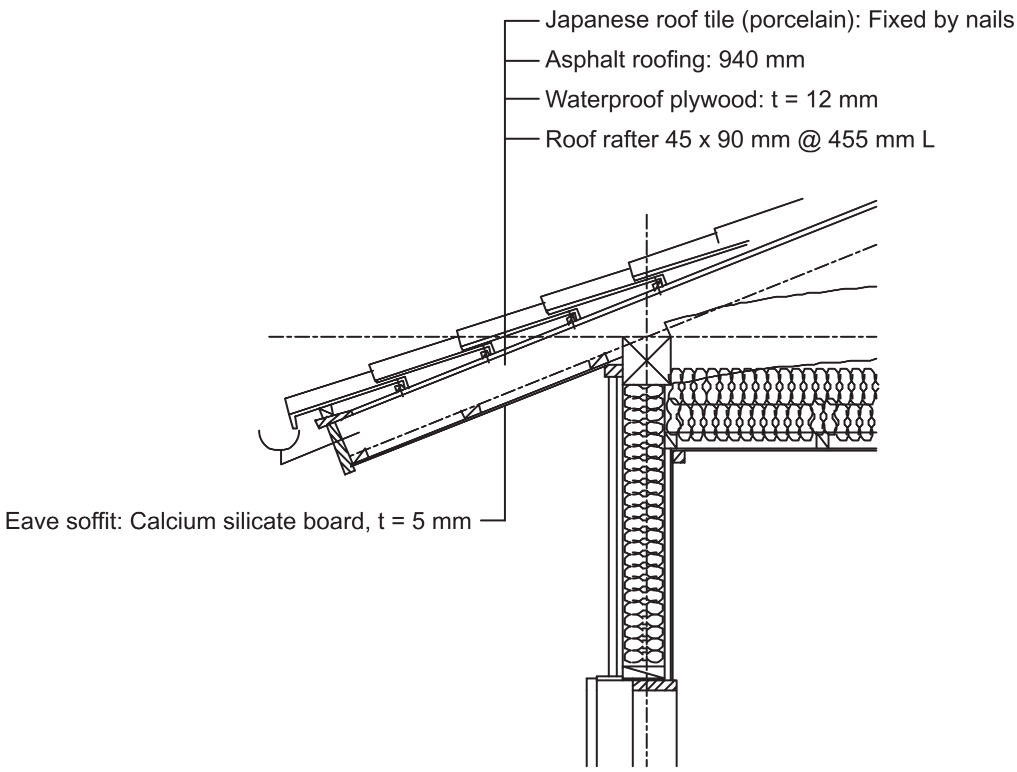
(Reference 3) Examples of Evaluation

In the case of Japanese roof tiles:

Durability of Japanese roof tiles: 60 years (Reference 1) ➞ Level 4

Laid by the dry construction method ➞ + 1 level as the Conditions for adding points are met.

Therefore, the use of Japanese roof tiles is evaluated as Level 5.



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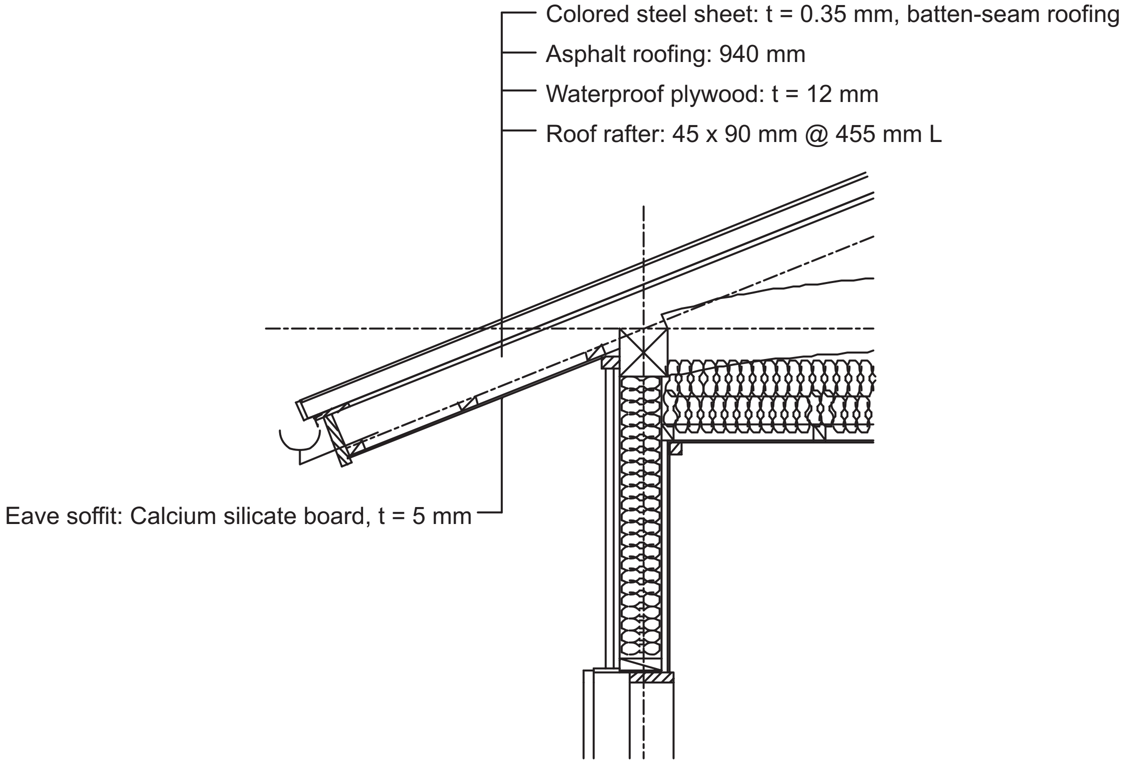
In the case of metal sheet batten-seam roofing:
Durability of colored steel sheets: 15 years (Reference 1) Å® Level 2
Laid by the dry construction method Å® + 1 level as the Conditions for adding points are met.
Therefore, the use of colored steel sheet is evaluated as Level 3.



1.4 Resistance against natural disasters

■ Assessment Item

Evaluate the strength of the building against natural disasters based on the strength of the building structure against earthquakes, in terms of resistance to collapse and destruction.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	The building satisfies the requirements of Grade 1 in Section 1-1, "Seismic Resistance Grades (Prevention of Collapse of Building Structures)," of the Japan Housing Performance Indication Standards.
Level 4	The building satisfies the requirements of Grade 2 in Section 1-1, "Seismic Resistance Grades (Prevention of Collapse of Building Structures)," of the Japan Housing Performance Indication Standards.
Level 5	The building satisfies the requirements of Grade 3 in Section 1-1, "Seismic Resistance Grades (Prevention of Collapse of Building Structures)," of the Japan Housing Performance Indication Standards.

Availability of conditions for adding points:

*None

Level change according to conditions:

*A building will be rated as Level 5 if seismic isolation or vibration control apparatus has been installed, provided that the performance of the apparatus is verified by demonstration tests as an integral part of the building, that the apparatus is used for the building in compliance with the established design method, and that such compliance with the method has been confirmed.

Assessment not applicable:

*None

2

■ Description

Although the Japan Housing Performance Indication Standards contain seven items in the category of "Structural Stability," evaluation is made only for one of these items, "Prevention of Collapse of Building Structures," as a representative of the seven items.

(Reference) Section 1-1, "Seismic Resistance Grades (Prevention of Collapse of Building Structures)," of the Japan Housing Performance Indication Standards

Seismic Resistance Grades (Prevention of Collapse of Building Structures)	Strength of the building frame against earthquakes, in terms of resistance to collapse and destruction
Grade 3	The building can withstand 1.5 times the strength of an earthquake (stipulated in Article 88, Clause 3 of the Building Standards Act) that occurs very rarely (once every few hundred years).
Grade 2	The building can withstand 1.25 times the strength of an earthquake (stipulated in Article 88, Clause 3 of the Building Standards Act) that occurs very rarely (once every few hundred years).
Grade 1	The building can withstand the strength of an earthquake (stipulated in Article 88, Clause 3 of the Building Standards Act) that occurs very rarely (once every few hundred years).

1.5 Fire preparedness

1.5.1 Fire-resistant structure (excluding openings)

■ Assessment Item

Evaluate exterior walls (excluding openings) where fire could spread, based on their fire resistance.

■ Assessment Level

Level	Criterion
Level 1	The building satisfies the requirements of Grade 1 in Section 2-6, "Fire Resistance Grades (Places Subject to Fire Damage (other than Openings))," of the Japan Housing Performance Indication Standards.
Level 2	(No corresponding level)
Level 3	The building satisfies the requirements of Grade 2 in Section 2-6, "Fire Resistance Grades (Places Subject to Fire Damage (other than Openings))," of the Japan Housing Performance Indication Standards.
Level 4	The building satisfies the requirements of Grade 3 in Section 2-6, "Fire Resistance Grades (Places Subject to Fire Damage (other than Openings))," of the Japan Housing Performance Indication Standards.
Level 5	The building satisfies the requirements of Grade 4 in Section 2-6, "Fire Resistance Grades (Places Subject to Fire Damage (other than Openings))," of the Japan Housing Performance Indication Standards.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
* Assessment is not applicable to exterior walls that have no places subject to fire damage.

■ Description

The scoring criteria are based on Section 2-6, "Fire Resistance Grades (Places Subject to Fire Damage (other than Openings))," of the Japan Housing Performance Indication Standards.

(Reference) Section 2-6, "Fire Resistance Grades (Places Subject to Fire Damage (other than Openings))," of the Japan Housing Performance Indication Standards

Seismic Resistance Grades (Fire Resistance Grades (Places Subject to Fire Damage (other than Openings))	Length of time for which flames and heat from a fire involving exterior walls (other than openings) where fire could spread are blocked
Grade 4	Flames are blocked for 60 minutes or more.
Grade 3	Flames are blocked for 45 minutes or more.
Grade 2	Flames are blocked for 20 minutes or more.
Grade 1	Other than the above

*Reason that evaluation is limited to places "other than openings":

When evaluating openings using the Japan Housing Performance Indication Standards, since "Grade 3: Flames are blocked for 60 minutes or more" is a specification that is not generally applied to detached houses, it is difficult to maintain consistency with the CASBEE assessment levels. Therefore, the evaluation only covers places "other than openings," and openings are excluded from evaluation.

1.5.2 Early detection of fire

■ Assessment Item

Evaluate how readily fire occurring in the house can be detected at an early stage based on the performance and location of alarm equipment.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	The building satisfies the requirements of Grade 1 in Section 2-1, "Detection Alarm System Installation Grades (in Case of Residential Fire)," of the Japan Housing Performance Indication Standards.
Level 4	The building satisfies the requirements of Grade 2 in Section 2-1, "Detection Alarm System Installation Grades (in Case of Residential Fire)," of the Japan Housing Performance Indication Standards.
Level 5	The building satisfies the requirements of Grade 3 or higher in Section 2-1, "Detection Alarm System Installation Grades (in Case of Residential Fire)," of the Japan Housing Performance Indication Standards.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

The scoring criteria are based on Section 2-1, "Detection Alarm System Installation Grades (in Case of Residential Fire)," of the Japan Housing Performance Indication Standards.

2

(Reference) Section 2-1, "Detection Alarm System Installation Grades (in Case of Residential Fire)," of the Japan Housing Performance Indication Standards

Detection Alarm System Installation Grades (in Case of Residential Fire)	Level of ease with which the outbreak of a fire in the house under evaluation can be detected at an early stage
Grade 4	Among possible fires that might occur in the house under evaluation, all fires that start in the kitchen or any living room are detected, and an alarm system that alerts all areas within the house has been installed.
Grade 3	Among possible fires that might occur in the house under evaluation, all fires that start in the kitchen or any living room are detected, and an alarm system that alerts the area around the room where the fire has occurred has been installed.
Grade 2	Among possible fires that might occur in the house under evaluation, all fires that start in the kitchen or bedrooms, etc. are detected, and an alarm system that alerts the area around the room where the fire has occurred has been installed.
Grade 1	Among possible fires that might occur in the house under evaluation, all fires that start in the bedrooms, etc. are detected and an alarm system that alerts the area around the room where the fire has occurred has been installed.

2 Maintenance

2.1 Ease of maintenance

■ Assessment Item

Evaluate the ease of maintenance of drainage pipes, water pipes, gas pipes, and electrical wiring based on the ease of replacement, etc.

■ Assessment Level

Level	Criterion
Level 1	The building satisfies the requirements of Grade 1 in Section 4-1, "Maintenance Grades (Dedicated Piping)," of the Japan Housing Performance Indication Standards.
Level 2	(May be selected if the Conditions for adding points are met.)
Level 3	The building satisfies the requirements of Grade 2 in Section 4-1, "Maintenance Grades (Dedicated Piping)," of the Japan Housing Performance Indication Standards.
Level 4	The building satisfies the requirements of Grade 3 in Section 4-1, "Maintenance Grades (Dedicated Piping)," of the Japan Housing Performance Indication Standards.
Level 5	(May be selected if the Conditions for adding points are met.)

Availability of conditions for adding points:
*Available
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

The ease of maintenance of the piping of the house is evaluated based on Section 4-1, "Maintenance Grades (Dedicated Piping)," of the Japan Housing Performance Indication Standards. The grades in the Japan Housing Performance Indication Standards are as follows:

(Reference)Section 4-1, "Maintenance Grades (Dedicated Piping)," of the Japan Housing Performance Indication Standards

Maintenance Grades (Dedicated Piping)	Degree of measures necessary to make maintenance (cleaning, inspection, and repair) of dedicated plumbing and gas pipes easier
Grade 3	Measures have been taken with special consideration for making maintenance easier, such as creating openings for cleaning and inspection.
Grade 2	Basic provisions have been made to make maintenance possible, such as not burying piping under concrete.
Grade 1	Other than the above

Conditions for adding points:
Satisfaction of the following conditions will raise the rating by up to two levels:

Part 1 Ease of additional installation or replacement of piping
The rating of the piping will be raised by one level when either of the following conditions is met:
a) A water-supply header method or hot-water-supply header method is used.
b) An underfloor collective piping system (such as a drainage header method, collective drainage basin method, etc.) is used.

Diagram of header-system water supply

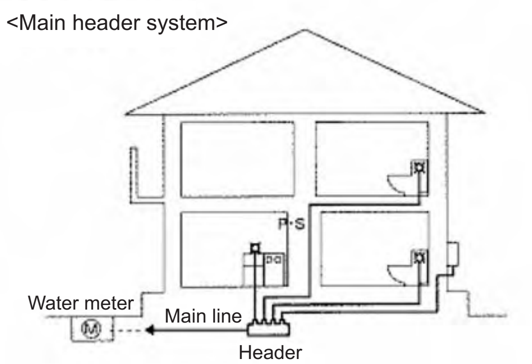
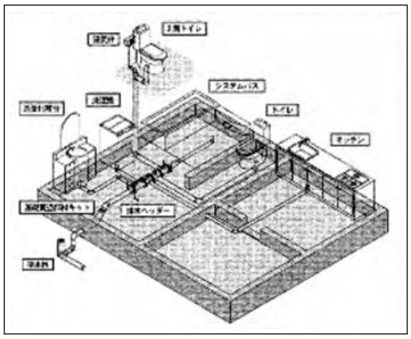


Diagram of header-system drainage



Part 2 Electric trunk line capacity planning
The rating of piping will be raised by one level when either of the following conditions is met:
a) For buildings using both electricity and gas, the electric trunk line capacity is designed assuming a load exceeding that stipulated in Interior Wiring Code 3605-1. The method of calculating a load based on Interior Wiring Code 3605-1 is shown below.

Design capacity of electric trunk line (VA) ≧ 40 VA/m^2 ✕ Total floor area m^2 + X.

2

*X is set at the following value according to the total floor area:

Total Floor Area	X
50 m^2 or less	2,500 VA
More than 50 and not exceeding 100 m^2	2,000 VA
More than 100 and less than 150 m^2	1,500 VA
150 m^2 or more	1,000 VA

*The Interior Wiring Code is a civil standard with specific regulations on design, implementation, maintenance, and inspection for the “Ordinance Prescribing Technical Standards regarding Electrical Facilities” based on the Electric Equipment Business Act.

b) For buildings served by electricity alone, the electric trunk line capacity is designed based on the following assumption:

Design capacity of electric trunk line (VA) ≧ (60 VA/m^2 ✕ Total floor area m^2 + X) ✕ Overlapping factor + Nighttime heat storage equipment capacity VA.

However, if the total floor area is small, and the assumed load excluding the nighttime heat storage equipment is less than 7,000 VA, the planned capacity will be 7,000 VA. The overlapping factor is defined as the ratio of the expected load current in the nighttime to the expected load current for ordinary loads and is generally set at 0.7 according to Interior Wiring Code 3545-2.

*X is set at the following value according to the total floor area:

Total Floor Area	X
50 m^2 or less	5,500 VA
More than 50 and not exceeding 100 m^2	5,000 VA
More than 100 and less than 150 m^2	4,500 VA
150 m^2 or more	4,000 VA

2.2 Maintenance system

■ Assessment Item

Evaluate efforts related to maintenance after the completion of construction that have a positive effect on the life performance of the house.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	No action taken.
Level 4	Corresponds to one of the Efforts to be evaluated.
Level 5	Corresponds to two or more of the Efforts to be evaluated.

Efforts to be evaluated

No.	Effort
1	A mechanism is incorporated for the implementation of periodic inspections as well as maintenance, repairs, and replacement at the appropriate times.
2	A mechanism is incorporated that provides information, such as manuals or periodicals, or a consultation service to assist the building occupants in continuing appropriate maintenance.
3	Basic information related to the building (such as design documents, construction records, specification member list, etc.) and the maintenance history of the building are maintained and used in follow-up inspections when any anomaly occurs.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

In order to realize a longer service life of a house, efforts that focus on software within a support system related to maintenance (including the provision of information for that purpose) are important. Maintenance is evaluated based on the availability of such a support system.

For information on housing maintenance, the House Maintenance Guidelines (see the following page) and the Home Inspection/Repair Recording Sheet provided by the Japan Housing Finance Agency ("JU MAP," available on the Agency's website http://www.jhf.go.jp/jumap/navi/reform/step1.html) can be used as references. Providing a maintenance program to the occupants with reference to the Japan Housing Finance Agency's materials by customizing it to meet the needs of the house provided by the supplier can be evaluated as a system that effectively promotes a longer service life of a house.

Reference: Home Maintenance Handbook (Detached House) Published by the Housing Loan Progress Association

Detached House (Wooden House)

House Maintenance Guidelines

	Inspected Part	Main Inspection Items	Inspection Period Guideline	Replacement Guideline
Exterior Parts	**Foundation**			
	Continuous footing	Cracks, termite paths, uneven settling, poor ventilation	Every 5-6 years	-
	Exterior Walls			
	Mortar walls	Staining, color fading, loss of color, cracks, peeling	Every 2-3 years	Consider repairing the entire wall after 15-20 years.
	Tiled walls	Staining, cracks, peeling		
	Siding walls (ceramics)	Staining, color fading, loss of color, cracks, deterioration of seals	Every 3-4 years	Consider repairing the entire wall after 15-20 years.
	Metal sheets, siding walls (metal)	Staining, rust, deformation, loosening	Every 2-3 years	Consider repairing the entire wall after 15-20 years (repaint every 3-5 years).
	Roof			
	Tile roofing	Displacement, cracks	Every 5-6 years	Consider entire reroofing after 20-30 years.
	Slate roofing	Color fading, loss of color, displacement, cracks, rust	Every 4-6 years	Consider entire reroofing after 15-30 years.
	Metal sheet roofing	Color fading, loss of color, rust, loosening	Every 2-3 years	Consider entire reroofing after 10-15 years (repaint every 3-5 years).
	Gutters (PVC)	Clogging, displacement, cracks		Consider replacing all gutters after 7-8 years
	Eave soffits	Decay, leaks, peeling, warping		Consider an entire repair after 15-20 years.
	Balconies, Verandas			
	Wooden parts	Decay, damage, termite damage, sinking of floor	Every 1-2 years	Consider replacing all after 15-20 years (repaint every 2-3 years).
	Metal parts	Rust, damage, loosening of handrails	Every 2-3 years	Consider replacing all after 10-15 years (repaint every 3-5 years).
	Aluminum parts	Corrosion, damage	Every 3-5 years	Consider replacing all after 20-30 years.
Structural Frames	**Flooring, Frames, Roof trusses**			
	Base, flooring	Decay, rust, termite damage, sinking of floor, creaking	Every 4-5 years	Consider replacing all except base after 20-30 years (reapply preservative treatment and termite repellant after 5-10 years).
	Pillars, beams	Decay, damage, termite damage, cracks, slanting, deformation	Every 10-15 years	-
	Walls (interior)	Cracks, leaks, joint fractures, decay, termite damage, rust		
	Ceilings, roof trusses	Decay, rust, peeling, warping, leaks, termite damage, cracks		
	Stairs	Sinking, decay, rust, termite damage, cracks		
External Work and Others	**Others**			
	Mailbox	Unstable fixing, damage, corrosion, deformation	Every year	Consider complete replacement after 10-25 years.
	Gates, fences	Slanting, peeling, cracks		-
	Alarm equipment	Malfunction, damage		Consider complete replacement after 12-18 years
	Security equipment			

(Note) The Inspection Period Guideline and Replacement Guideline vary significantly depending on the conditions of the building site, construction cost, and usage conditions as well as the degree of daily checks and maintenance. The figures listed above are rough general guidelines.

2

	Inspected Part	Main Inspection Items	Inspection Period Guideline	Replacement Guideline
Indoor Parts	**Floor Finish**			
	Wood floor	Creaking, warping, dirt	As needed	Consider according to conditions.
	Carpeted floor	Mold, mites, dirt	Full-scale cleaning every 1-2 years	Consider recarpeting every 6-10 years.
	Tatami floor	Unevenness, mites, discoloration, dirt	Tatami drying 1-2 times a year, tatami reversal every 2-3 years.	2-3 years after reversal
	Vinyl floor	Peeling (curling), dirt, cracks due to deterioration	As needed	Consider according to conditions.
	Entrance floor	Dirt and cracks on tiles etc., peeling		
	Wall Finish			
	Walls with vinyl wallpaper	Mold, peeling, dirt	As needed	Consider according to conditions.
	Walls with textile-type wallpaper			
	Wooden board walls, fancy plywood walls	Loosening, peeling, discoloration, dirt, cracks		
	Fiber-/sand-coated walls	Peeling, dirt		
	Ceiling Finish			
	Japanese-style room ceiling (fancy plywood boards with spaces in between)	Staining, dirt	As needed	Consider according to conditions.
	Western-style room ceiling (vinyl-wallpapered finish)			
Fixtures	**Exterior Fixtures**			
	Entrance fixtures	Gaps, opening/closing malfunction, corrosion, problems with attached metal parts	Every 2-3 years	Consider replacing after 15-30 years (adjust fit as needed).
	Aluminum sashes			
	Rain shutter doors, screen doors	Rust, decay, fitting problems		
	Wooden parts of window frames, door storage cases, etc.	Decay, leaks, caulking problems	Every 2-3 years	Consider when replacing exterior fixtures.
	Interior Fixtures			
	Wooden fixtures	Gaps, opening/closing malfunction, problems with attached metal parts	Every 2-3 years	Consider replacing after 10-20 years (adjust fit as needed).
	Sliding paper doors, sliding paper screens	Gaps, opening/closing malfunction, damage, dirt	Change paper screens every 1-3 years.	Consider replacing after 10-20 years (adjust fit as needed).
Facilities	**Plumbing Facilities**			
	Water-supply pipes	Leaks, rusty water	Every year	Consider replacing all after 15-20 years.
	Faucet equipment	Leaks, wear of packings, degradation of plastic parts		Consider replacing after 10-15 years (replace packings every 3-5 years).
	Drainpipes, traps	Leaks, clogging, bad odor		Consider replacing all after 15-20 years.
	Kitchen sink, bathroom facilities	Leaks, cracks, corrosion, poor ventilation, rust, wear of sealings, dirt		
	Toilet	Lavatory basin and tank leaks, bad odor, mold, poor ventilation, patina on metal parts, clogging		
	Bathroom			
	Tile finish	Cracks in tiles, dirt, mold, deterioration of sealings, clogging of drain outlet	Every year	Consider replacing all after 10-15 years.
	Unit bath	Cracks in joint parts, gaps, dirt, mold, clogging of drain outlet		
	Gas Facilities			
	Gas pipes	Gas leaks, deterioration and aging of pipes	Every year Aging and deterioration of pipes	Consider replacing all after 15-20 years.
	Hot-water supply equipment	Water leaks, gas leaks, problems with equipment		Consider replacing after 10 years.
	Others			
	Ventilation equipment (fans)	Malfunction	Every year	Consider replacing all after 15-20 years.
	TV reception equipment (antennas, etc.)	Unstable fixing, damage, rust, deformation		Consider replacing all after 12-18 years.
	Electrical equipment (outlets, etc.)	Malfunction, damage		Consider replacing all after 15-20 years.

3 Functionality

3.1 Size and layout of rooms

■ Assessment Item

Evaluate the appropriate size of the floor area of the house and whether the necessary living rooms are secured.

■ Assessment Level

In cases where the number of occupants has not yet been determined, or when the number of occupants is fixed at four or more, the evaluation will be based on <No. of occupants: 4 (Default)> (a four-member family (husband, wife, and two children) is assumed).

In cases where the number of occupants is fixed at less than 4, the evaluation can be based on different criteria corresponding to the number of occupants.

<No. of occupants: 4 (Default)>

Level	Criterion
Level 1	(No corresponding level)
Level 2	Total floor area < 50 m^2
Level 3	50 m^2 ≦ Total floor area < 125 m^2
Level 4	125 m^2 ≦ Total floor area
Level 5	(May be selected if the Conditions for adding points are met.)

<No. of occupants: 3>

Level	Criterion
Level 1	(No corresponding level)
Level 2	Total floor area < 40 m^2
Level 3	40 m^2 ≦ Total floor area < 100 m^2
Level 4	100 m^2 ≦ Total floor area
Level 5	(May be selected if the Conditions for adding points are met.)

<No. of occupants: 2>

Level	Criterion
Level 1	(No corresponding level)
Level 2	Total floor area < 30 m^2
Level 3	30 m^2 ≦ Total floor area < 75 m^2
Level 4	75 m^2 ≦ Total floor area
Level 5	(May be selected if the Conditions for adding points are met.)

<No. of occupants: 1>

Level	Criterion
Level 1	(No corresponding level)
Level 2	Total floor area < 25 m^2
Level 3	25 m^2 ≦ Total floor area < 55 m^2
Level 4	55 m^2 ≦ Total floor area
Level 5	(May be selected if the Conditions for adding points are met.)

Availability of conditions for adding points:
*Available

Level change according to conditions:
*None

Assessment not applicable:
*None

■ Description

The scoring criteria are based on the floor spaces of the targeted housing standards for rural areas and the floor spaces of the minimum housing standards set forth in the Basic Program for Housing (National Plan) determined at a meeting of the Cabinet in September 2006.

Level	Criterion
Level 2	Does not conform with the floor spaces of the minimum housing standards.
Level 3	Conforms with the floor spaces of the minimum housing standards but does not conform with the floor spaces of the targeted housing standards for rural areas.
Level 4	Conforms with the floor spaces of the targeted housing standards for rural areas.

In cases where the number of occupants has not been defined, the evaluation is based on the default assumption of a general four-member family (husband, wife, and two children).

When the number of occupants is defined as less than four, since it can be assumed that a more comfortable living environment is provided compared to evaluation based on the default assumption, the evaluation may be based on the criterion corresponding to the actual number of occupants.

Evaluation based on the actual number of occupants would also make sense for cases where the number of occupants exceeds four, but since detached houses that accommodate four people are easy to put into circulation as second-hand homes, and can therefore become good stock, the evaluation is based on the default assumption.

Conditions for adding points:

The rating will be raised by one level when the living rooms satisfy all of the following conditions:

1) A dedicated kitchen and other housework space as well as a toilet (flushing toilet in principle), washbasin, and bathroom are constructed.
2) Storage space of a size appropriate for the household composition is installed.

(Reference 1) Floor Space of Houses

The floor space of the house is evaluated using evaluation levels based on the Basic Program for Housing (National Plan). The floor spaces of the targeted housing standards for rural areas and the floor spaces of the minimum housing standards used in setting our criteria are outlined below.

*Floor spaces of the targeted housing standards for rural areas

- As an indicator of the size of houses, the floor spaces of the targeted housing standards have been set as an objective of the National Plan, Item 3, "General improvement of the residential housing market in order to appropriately meet a broad range of residential needs."
  The actual standards are as follows:

[Resolving disparities between residential needs and residential housing stock]

Achievement rates of floor spaces of the targeted housing standards among families with small children (refer to Note):

→ Nationwide: 42% (2003) → 50% (2010)
Metropolitan areas: 37% (2003) → 50% (2015)

(Note) Families with small children: Families that have a child under the age of 18.

- The floor spaces of the targeted housing standards consist of the floor spaces of the targeted housing standards for rural areas, based on the assumption of detached houses in the suburbs and areas other than urban areas, and the floor spaces of the targeted housing standards for urban areas, based on the assumption of apartment complexes in urban districts and their surrounding areas. Since CASBEE for Home (Detached House) covers detached houses, this evaluation uses the former standards.
- Equations for floor spaces of the targeted housing standards for rural areas:
  * Single-person household: 55 m^2
  * Household with two or more members: 25 m^2 ✕ Number of household members + 25 m^2

*Floor spaces of the minimum housing standards

- As an indicator of the size of houses, the floor spaces of the minimum housing standards have been set as an objective of the National Plan, Item 4, "Securing stability of residence for those in special need of consideration in securing a home."
  The actual standards are as follows:

[Securing stability of residence]

- Rate of nonfulfillment of floor spaces of the minimum housing standards → Resolve at an early date.
- Equations for floor spaces of the minimum housing standards:
  - * Single-person household: 25 m^2
  - * Household with two or more members: 10 m^2 ✕ Number of household members + 10 m^2

(Reference 2) Conditions for Adding Points

Conditions for adding points were set with reference to the layout of rooms having basic functions in the residential performance standards set in the Basic Program for Housing (National Plan). An outline is given below.

- In one of the objectives of the Basic Program for Housing (National Plan), Item 1, "Creating a stock of high-quality housing, and bequeathing it to future generations," Section (1), "Maintenance and improvement of housing quality or performance," the creation of housing stock based on the Housing Performance Standards is described as a goal.
- The Housing Performance Standards consist of three parts: Basic functions, Living performance, and Exterior performance. The "Basic functions" part contains guidelines for room layouts.
- Item (1) in the original text (see below) concerns the size of a house; therefore, items (2) and (3) were used as Conditions for adding points.

Excerpt from the Basic Program for Housing (National Plan)

Attachment 1 Housing Performance Standards

The Housing Performance Standards are guidelines for creating a stock of quality housing, which possess functions and performance that meet the needs of occupants and the requirements of society. The details are as follows:

1 Basic functions

(1) Layout of rooms, etc.

① Appropriate levels of standards that take into account individual privacy, family gatherings, entertainment of guests, and leisure activities should be secured in the layout and size of rooms. In an apartment complex in an urban area, appropriate levels should be secured taking into account the conveniences of the city in addition to individual privacy, family gatherings, etc.

② A dedicated space for a kitchen and other household work, a toilet (flushing toilet, as a rule), a washroom, and a bathroom must be secured. However, if a kitchen and a bathroom for common use of appropriate size are provided, a minikitchen, flushing toilet, and washbasin will suffice as facilities for exclusive use in each individual room.

③ Storage space of a size appropriate to the household composition should be secured.

(Remainder of text omitted.)

2

3.2 Barrier-free design

■ Assessment Item

Evaluate efforts made to accommodate deterioration of physical functions as a result of the aging of occupants.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	The building satisfies the requirements of Grade 1 in Section 9-1, "Elderly Friendliness Grades (Dedicated Spaces)," of the Japan Housing Performance Indication Standards.
Level 3	The building satisfies the requirements of Grade 2 in Section 9-1, "Elderly Friendliness Grades (Dedicated Spaces)," of the Japan Housing Performance Indication Standards.
Level 4	The building satisfies the requirements of Grade 3 in Section 9-1, "Elderly Friendliness Grades (Dedicated Spaces)," of the Japan Housing Performance Indication Standards.
Level 5	The building satisfies the requirements of Grade 4 or higher in Section 9-1, "Elderly Friendliness Grades (Dedicated Spaces)," of the Japan Housing Performance Indication Standards.

Availability of conditions for adding points:

*None

Level change according to conditions:

*None

Assessment not applicable:

*None

■ Description

The scoring criteria are based on Section 9-1, "Elderly Friendliness Grades (Dedicated Spaces)," of the Japan Housing Performance Indication Standards.

The evaluation grades of the Japan Housing Performance Indication Standards are described below.

(Reference) Section 9-1, "Elderly Friendliness Grades (Dedicated Spaces)," of the Japan Housing Performance Indication Standards

Elderly Friendliness Grades (Dedicated Spaces)	Degree of measures necessary for the care of elderly people in dwelling units
Grade 5	Measures have been taken to allow elderly people to move around safely, and measures in which special attention is paid to help wheelchair users lead a normal life have also been taken.
Grade 4	Measures have been taken to allow elderly people to move around safely, and measures in which attention is paid to help wheelchair users lead a normal life have also been taken.
Grade 3	Basic measures have been taken to allow elderly people to move around safely, and basic measures that allow wheelchair users to lead a normal life have also been taken.
Grade 2	Basic measures have been taken to allow elderly people to move around safely.
Grade 1	Measures to ensure the safety of elderly people when moving around in the dwelling unit have been taken, to the degree that meets the requirements stipulated in the Building Standards Act.

1 Consideration of the Townscape and Landscape

■ Assessment Item

Evaluate positive actions to establish improved scenery while promoting harmony with the surrounding townscape and landscape.

■ Assessment Level

Level	Criterion
Level 1	The building shows no consideration of harmony with the surrounding townscape and landscape as it inappropriately stands out in the neighborhood.
Level 2	(No corresponding level)
Level 3	The building shows consideration of the surrounding townscape and landscape but does not satisfy the criterion of Level 4.
Level 4	Efforts to be evaluated No. 1 or two actions out of Efforts to be evaluated No. 2 actions [1] through [5] have been implemented for the building.
Level 5	Efforts to be evaluated No. 1 as well as one action out of Efforts to be evaluated No. 2 actions [1] through [5], or three or more actions out of Efforts to be evaluated No. 2 actions [1] through [5] have been implemented for the building.

Efforts to be evaluated

No.	Classification	Effort
1	Harmony with the neighboring buildings and community	The building ensures that the following factors do not have an inappropriately conspicuous appearance in contrast to the neighboring residential landscape and presents a continuous or harmonious consistency with the neighbors. • Layout of the building proper (particularly the relationship with the front road) • Height and roof shape of the building proper • Color of the exterior walls and roof of the building proper • Wall or fence in contact with the road and green space • Layout, color, or shape of other factors such as carport, outdoor equipment, outdoor storage shed, etc.
2	Active harmonization with the surrounding townscape and landscape	[1] The garden design or layout, choice of trees planted, and layout of tree planting are implemented so as to contribute to the local townscape.
		[2] Lighting, furniture, fences, etc. are designed and installed so as to make the road look attractive, thereby contributing to the creation of a better landscape.
		[3] Building service equipment, refuse collection equipment, etc. are hidden by louvers or plants so as to make them unobtrusive.
		[4] The building incorporates various architectural elements, such as the design and exterior plan, that match the location.
		[5] Measures have been taken based on the local landscape plan, etc.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

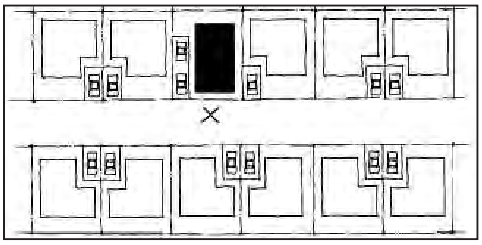
The beauty of the townscape and landscape is not evaluated here.
Efforts subject to evaluation are graded with reference to the following examples:

1) "Efforts to be evaluated No. 1" are evaluated if efforts are made to ensure that the planned area and building are harmonious with the roads around the area, the neighboring houses, and the scenery of the block. If there is no harmony between the planned area and surrounding situation or an unfavorable tendency is seen, "Efforts to be evaluated No. 2" are used for evaluation.

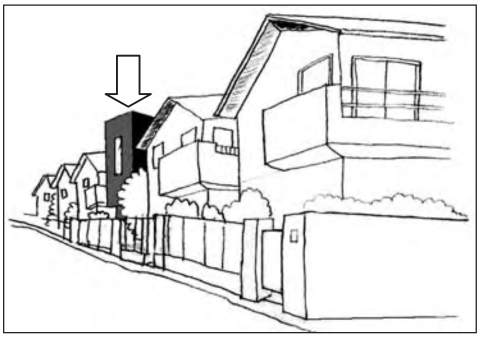
2

*Examples that do not satisfy the requirements of "Efforts to be evaluated No. 1":

- The house does not match the arrangement of the neighboring houses.



- The house has a roof that does not match those of the neighboring houses in terms of shape and color.



- The fence or hedge adjoining the road inappropriately stands out in the neighboring residential area and natural scenery.

2) Actions [1] through [4] in "Efforts to be evaluated No. 2" are considered to contribute to creation of the local scenery by making optimal use of the characteristics of the area through positive consideration for the townscape and landscape. They include active efforts such as the design of the exterior appearance and external area of the house, setting of lighting, and landscaping of the parking space, to make the townscape more attractive.

3) Action [5] in "Efforts to be evaluated No. 2" should be based on the landscape plan formulated by the local government or residents, such as landscape agreements, guidelines, ordinances, "Housing with Proper Environment" (HOPE) plans, and "Wood Town" projects.

4) The special efforts in Level 5 should include actions [1] through [4] in "Efforts to be evaluated No. 2" if "Efforts to be evaluated No. 1" are adopted in Level 4.

5) If the townscape has not yet been established because it is a new residential area, "Efforts to be evaluated No. 2" are to be adopted.

2 Creating the Biological Environment

2.1 Greening of the premises

■ Assessment Item

Evaluate the greening of the premises using the ratio of the green area to the external area.

■ Assessment Level

Level	Criterion
Level 1	The building does not satisfy the criterion of Level 2.
Level 2	The building has a green area that comprises 20% or more of the external area.
Level 3	The building has a green area that comprises 30% or more of the external area.
Level 4	The building has a green area that comprises 40% or more of the external area.
Level 5	The building has a green area that comprises 50% or more of the external area.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

In general, the securable size of external area and difficulty of greening differ between urban and suburban areas. The estimated external area is therefore calculated using the building coverage ratio designated for each land use zone as an index, and the evaluation is made using the ratio of the green area to the external area. The following equation is used to calculate the ratio of the green area to the external area:

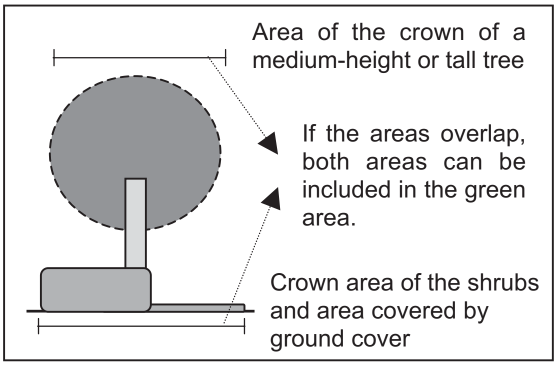
2

Ratio of green area = Green area / Estimated external area,

where Estimated external area = (1 - Designated building coverage rate) ✕ Site area.

- The green area includes any planted areas on the roof and walls and areas of open water in addition to areas of woods and ground cover.

- If the crowns of shrubs and ground cover overlap those of medium-height and tall trees, both areas can be included in the green area. However, neither the overlap between medium-height and tall trees nor the overlap between shrubs and ground cover are to be included in the green area.



Example of overlap between tall trees and shrubs

For the selection of plants and grasses, it is preferable to adopt local plants and indigenous trees as much as possible from the viewpoint of preserving the regional biological environment and inheriting the regional scenery unique to the natural environment of the region. (Refer to LRH3.2.2: Preservation of the existing natural environment.)

Details on How to Calculate the Green Area

The following guidelines should be used to calculate the green area:

① Green area on the ground

The green area of trees (tall trees, medium-height trees, and shrubs) is the area of the fully grown tree crown when projected onto the ground. The area of ground cover is the area covered by fully grown ground cover (the horizontally projected area that the ground cover is planned to cover).

*How to calculate the crown area

Each municipality uses its own method to calculate green areas in its greening plans, and there is no general-purpose database describing the various types of methods for calculating crowns and various types of plants. In addition, each municipality usually has its own definition of tall trees, medium-height trees, and shrubs.

A unique method for calculating green areas using CASBEE for Home (Detached House), which can be used both for planned trees and existing trees, is shown below.

i) Calculation of crown areas at the time of planning (Source: "Guidelines for Greening Plans" by the Tokyo Metropolitan Government)

The method of calculating the crown area is defined below in accordance with the "Guidelines for Greening Plans" by the Tokyo Metropolitan Government, by which the crown area can be evaluated depending on the height of the trees while growing. When medium-height trees have reached a height of 3 m, they are treated as tall trees.

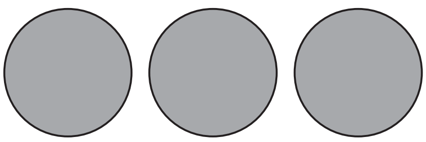
Table: Definition of crown area

Classification of tree	Height when planted	Height when planted	Crown area
Tall tree	2.0 m or more	3.0 m or more	$\pi \times (H \times 0.7 / 2)^2$
		Less than 3.0 m	3 m^2
Medium-height tree	1.2 m or more	2.0 m	2 m^2

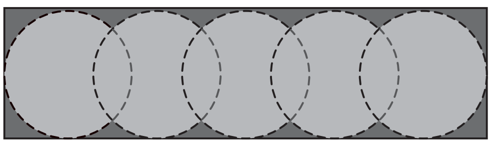
*H: Height of the tree (m)

ii) Calculation of the crown area of existing trees (Part of this section is excerpted from "Guidelines for Greening of Business Places" by the Hiratsuka Municipal Government.)

To calculate the crown area of existing trees, the horizontally projected area of the existing tree crowns is calculated. In this case, the following method is used to calculate the crown area if several trees stand in parallel and the tree crowns overlap:



Tree crowns do not overlap.
(Total of the crown area of all trees)



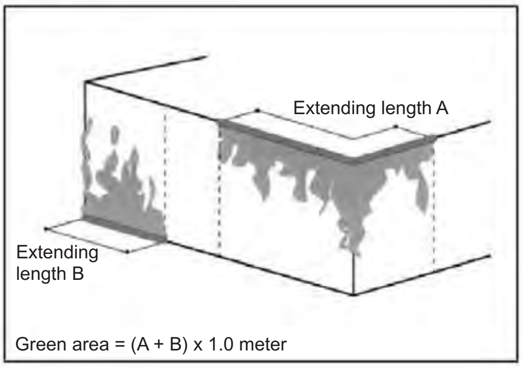
Tree crowns overlap.
(Area enclosed by the lines that connect the circumferences of the crowns)

② Green area on the rooftop

The green area should be the base on which trees and ground cover are planted. However, if the crown extends beyond the boundary of the plant base when the trees and ground cover are fully grown, it is possible to include the projected area of the crown part outside the base in the green area.

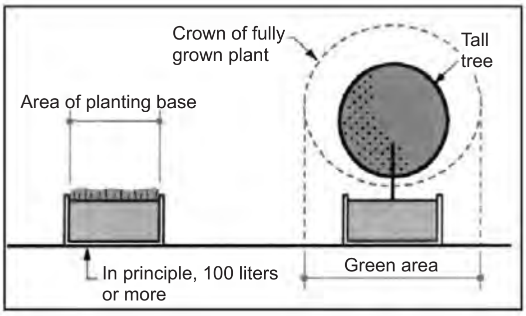
③ Green area on walls

When a wall is upright, the planned green area is calculated by multiplying the length of the planted part of the wall by 1 m. If the wall is sloping, the area is obtained by horizontally projecting the planned green part. This rule applies to a green area that ascends from the ground, a green area that descends from the top of the wall such as from the rooftop, and a green area using a base installed on the wall. If two or more methods among the above three greening methods are used concurrently on the same wall, duplication is not permitted in the calculation of the green area. This rule also applies to the walls of verandas and balconies.



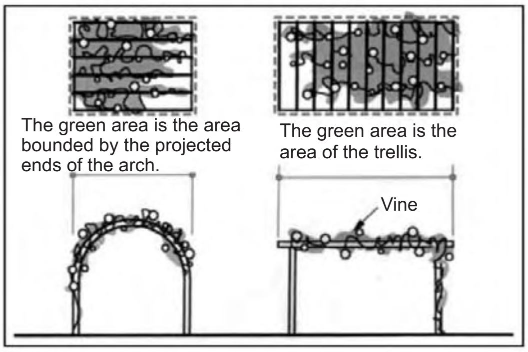
④ Green area of movable planting base (such as a planter)

In the case that a movable planting base is installed on the ground or on the rooftop, such a base with a cubic capacity of 100 liters or more is subject to calculation, and the area of the planting base should be taken as the green area. However, if the crown of the fully grown plant extends beyond the planting base, the projected area of the crown beyond the planting base can be added to the green area. If a planting base is used for the green area on a wall, the method used for calculating the green area on a wall applies.



⑤ Green area of trellis plants

If a trellis is installed on the ground or on the rooftop, the green area is the area of the trellis that is covered by the fully grown vines (the horizontally projected area that it is planned the vines will cover).



⑥ Green area of a hedge

The green area is the area obtained by multiplying the length of the hedge by its width. However, it is possible to calculate the green area by assuming that the hedge is 0.6 m wide.

■ Explanation of Terminology

Tree:

Trees include tall trees, medium-height trees, and shrubs, and bamboo is also included.

A tall tree usually has a simple stem that grows thicker, and the simple stem is clearly distinguishable from the branches. It grows high. No clear criterion is given for a tall tree, but it should be not less than two meters in height both when it is planted and when it is fully grown.

A medium-height tree is generally two to three meters high. The medium-height trees mentioned in this section are not less than 1.2 meters in height when planted and extend to a height of about two meters when fully grown. (A tree that grows higher than two meters is regarded as a tall tree.)

A shrub does not grow high even when fully grown. It is usually a bushy type of plant that does not grow a main stem, although some bushes have a simple stem and do not grow into a bushy form. The shrubs discussed here do not grow higher than two meters.

Ground cover:

Ground cover covers the surface of the ground. Examples include lawn grass, lily-turf, ivy and the like, bamboo grass and the like, and ferns.

Trellis plants:

Trellis plants include those grown on a wisteria trellis, grapevine trellis, or gourd trellis, as well as those grown on an arch-type trellis.

Planting base:

This refers to an area of soil that has a certain thickness to serve as a base for the growth of plants or ground cover.

Movable planting base:

A movable planting base is typically a planter or other container filled with soil. It is installed in a stable manner. A container with a cubic capacity of 100 liters or more is regarded as a movable planting base for the purposes of this evaluation.

Tree crown and projected area of tree crown:

A tree crown is the mass of branches and leaves at the upper part of a tree. The projected area of a tree crown is the estimated horizontally projected area of the tree when it is fully grown.

Tree crown of fully grown tree:

This indicates the size of growth of a tree crown 10 years after it has been planted, as estimated by the planner.

Ground, rooftop, and walls:

The ground includes any artificial ground coupled with the ground. The rooftop consists of the roof portions of a building and includes the floors of balconies and verandas. The walls are the exterior walls of the building, and include the exterior walls of balconies and verandas.

Open water:

Ponds, streams, etc.

2.2 Ensuring the biological habitat

■ Assessment Item

Evaluate efforts that contribute to the inhabitation and growth of living things.

■ Assessment Level

Level

Level	Criterion
Level 1	The building has no specific considerations.
Level 2	(No corresponding level)
Level 3	One or more of Efforts to be evaluated No. 1 through 5 have been implemented.
Level 4	(No corresponding level)
Level 5	Three or more of Efforts to be evaluated No. 1 through 5 have been implemented.

Efforts to be evaluated

No.	Effort
1	<Movement routes> Efforts are made to ensure continuity of greenery so as to allow wild birds to move around in the area.
2	<Feeding grounds> Efforts are made to plant trees that feed wild birds or on which wild birds can feed.
3	<Habitats and shelters> Efforts are made to ensure spaces for wild birds to hide or nest.
4	<Watering areas> Efforts are made to maintain watering areas for wild birds to drink water or bathe.
5	<Porous spaces> Porous materials are effectively used to allow small animals to live and grow.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

Under the National Biodiversity Strategy of Japan, Japan has been promoting efforts to preserve the biological environment. It is therefore strongly desirable for residential areas to preserve and create an environment where living things exist and grow by developing networks of greening efforts with urban areas.

Positive efforts are needed if a rich biological environment is found in the environs of a planned district. Even if a rich environment is not found in the environs, positive efforts are needed to enable the planned district to contribute to improvement of the biological environment by rebuilding and upgrading residences for the future.

For the purpose of this evaluation, wild birds are assumed to be the main fauna serving as an indicator. (Efforts related to fauna other than wild birds are acceptable.) The existence of wild birds is one of the indications by which the current ecosystem of a locality can be grasped, and it is possible to increase compatibility with the local environment by creating spaces for existence with wild birds in the residential area.

For the planning of efforts, it is advisable to research and confirm the circumstances of the continuity and network (including those of the steppingstone arrangement) of areas of greenery and water that allow local fauna (wild birds, butterflies, dragonflies, frogs, cicadas, etc.) to move around, and to embody the research results in the external area plan.

1) Securing movement routes

If there is continuity of greenery, animals move using it as a pathway. Wild birds fly between tree crowns, and butterflies move along areas of greenery. Crickets move along the bases of shrubs and grass to conceal themselves. It is therefore advisable to arrange shrubs and hedges properly so as to ensure continuity of greenery.

2) Securing feeding grounds

The planting of various types of plants facilitates the life of various animals that live on the nectar of these plants. It is desirable to plant not less than three types of trees and plants that bear flowers or fruit.

Examples

Wild birds: Because each type of wild bird has its own feeding ground, it is possible to attract many types of wild birds by planting plants of varying heights that bear fruit; that is, tall trees, medium-height trees, and shrubs as well as undergrowth, etc.

Butterflies: The larvae of some species eat only the leaves of specific plants. Adult butterflies consume tree sap and fermented fruit as well as nectar. To allow many adult butterflies to live on the trees, it is advisable to plant various types of plants in consideration of their blooming times so that they bloom in succession, thus supplying nectar continuously for as long as possible.

3) Securing habitats and shelters

Wild birds perch, eat, and rest on the branches of large trees. Large trees serve as shelters for them as well as landmarks while they are on the wing. They raise their young among the branches and in cavities. Undergrowth and piles of fallen leaves are habitats for insects such as crickets.

Large trees in this context mean trees expected to grow as high as three meters or more as well as hedges 0.6 meters or more in thickness.

4) Securing watering areas

Because it is difficult to find natural watering areas in urban locations, a watering area plays an important role in the habitat of animals, irrespective of how small it may be. Wild birds fly to shallow watering areas to drink and bathe. Dragonflies and frogs come to stagnant ponds.

5) Securing porous spaces

Stonework using natural stone, gabions, or palm roll mats creates many porous spaces where plants and small animals can live. When small animals are present, wild birds that feed on them also gather around these spaces.

(Reference 1) Detailed information on plans and actions in consideration of the habitats of fauna and specific types of flora can be obtained on the website of the Eco-Gardening Society.

Home page http://eco-garden.net/

- Database of Japanese indigenous plants: Trees
- Database of Japanese indigenous plants: Ground cover plants and vines
- Database of wild birds and trees that provide sources of food
- Database of butterflies and plants that provide sources of food

(Reference 2) National Biodiversity Strategy of Japan and preservation of fauna

The Japanese government has enacted legislation for preservation of the natural environment such as the Basic Environment Act. The government formulated the National Biodiversity Strategy of Japan in October 1995, and has been promoting actions for preserving the biological environment in Japan. The objective of the National Biodiversity Strategy is to preserve biodiversity on the assumption that the country's land does not merely consist of its geographical territory, but also encompasses everything from the underground realm to the air, subterranean water, and the ocean, and from microorganisms to birds.

It is important to establish networks of the valuable natural environment remaining inside urban areas so as to restore the environment that supports an abundance of flora and fauna. In this sense, it is necessary to secure habitats for small animals and promote the establishment of living environments that coexist with nature by actively improving green infrastructure in line with appropriate actions to preserve the remaining natural environment.

Detailed information on Japan's biodiversity policies can be obtained on the website of the Biodiversity Center of Japan, Nature Conservation Bureau, Ministry of the Environment:
http://www.biodic.go.jp/index.html

3 Safety and Security of the Region

■ Assessment Item

Evaluate measures to strengthen disaster prevention and crime prevention for the neighboring area.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	None of Efforts to be evaluated No. 1 through 4 have been implemented.
Level 4	One of Efforts to be evaluated No. 1 through 4 has been implemented.
Level 5	Two or more of Efforts to be evaluated No. 1 through 4 have been implemented.

Efforts to be evaluated

No.	Effort
1	An evacuation route and space for firefighting are secured.
2	Highly fire-resistant plants are planted.
3	A good sightline is maintained.
4	Others

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

In this section, actions for the prevention of disaster and crime are evaluated.

1) Securing of an evacuation route and space for firefighting

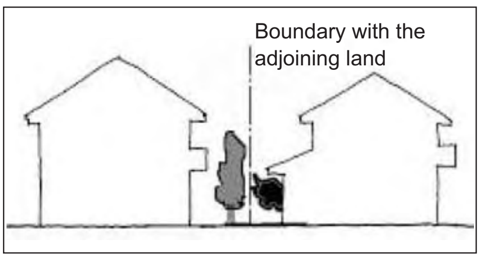
The basic role of an evacuation route is to provide evacuees with safe passage and to facilitate firefighting in the event of a disaster. Efforts to facilitate evacuation at a time of disaster are evaluated. They include constructing an open external area, greening with the help of hedges and lightweight fences, arrangement of structures, and consideration for falling objects.

2) Planting of highly fire-resistant plants

The planting of greenery at boundaries with the neighboring areas and the areas that adjoin the road is effective to stop fires and deter the spread of fire in areas vulnerable to fire disaster such as an urban area with a high concentration of wooden houses. The following actions are evaluated:

- The planting of trees with high fire resistance (refer to the following table) in a dense configuration so as to form a hedge (e.g., every two meters) in places where fire is more likely to occur (such as the kitchen) of the neighboring house or close to the windows of the house.

- The planting of a hedge of 1.5 to 1.8 meters in height using trees with high fire resistance.



Fire-resistance characteristics of plants

- Evergreen trees and plants with thick leaves that contain large amounts of water have high fire resistance.
- They are represented by *Viburnum odoratissimum*, oaks and the like, *Castanopsis*, and *Podocarpus macrophyllus*. The following table gives the names of other representative trees.

Fire resistance of plants

Fire resistance	Types of trees
High	*Podocarpus macrophyllus, Sciadopitys verticillata, Cunninghamia lanceolata, Castanopsis sieboldii, Quercus acuta, Quercus myrsinaefolia, Machilus thunbergii, Cinnamomum japonicum* Sieb*, Ilex integra, Ilex rotunda, Ligustrum japonicum, Rhaphiolepis umbellata, Photinia glabra, Myrica rubra, Ilex latifolia, Camellia japonica* and the like*, Camellia sasanqua, Ternstroemia gymnanthera, Cleyera japonica, Illicium anisatum, Nerium indicum, Viburnum awabuki, Euonymus japonicus, Aucuba japonica, Fatsia japonica, Daphniphyllum macropodum, Daphniphyllum teijsmannii, Poncirus trifoliate, Garcinia subelliptica*
Medium	*Chamaecyparis obtusa, Chamaecyparis pisifera, Taxus cuspidata, Ginkgo biloba, Lithocarpus edulis, Quercus phillyraeoides, Quercus dentata, Osmanthus heterophyllus, Swida controversa, Ficus carica, Melia azedarach, Liriodendron tulipifera, Paulownia tomentosa, Firmiana simplex, Platanus orientalis, Eurya japonica, Pittosporum tobira, Ilex crenata, Gardenia jasminoides, Hydrangea, Rhododendron* and the like*, Weigela coraeensis*

Source: “Humans and the Forest—The Environmental Control Functions of Forests” edited by Yoshiya Tadaki and Tatsuo Kira

3) Maintenance of a good sightline

For crime prevention in the surrounding and neighboring areas, fences, barriers, and hedges adjoining roads are evaluated in terms of whether they allow mutual visibility between the residential area and the road. Generally, their height should be about 1.2 to 1.6 meters. For tall trees, consideration for the selection of those whose crown is above the sightline is evaluated.

At the same time, the installation of outdoor lights and gate lights equipped with sensors is evaluated in terms of efforts to secure sufficient illumination to observe human behavior at nighttime.

2

4) Others

In addition, efforts focused on places considered to be dangerous in the event of a disaster from the viewpoint of location are evaluated, as well as efforts focused on disasters that require special attention from the viewpoint of the local characteristics (for example, flooding of a river, ground disasters [landslides], and tsunami). At the same time, efforts for the prevention of disasters and crime incorporated in local ordinances and plans are evaluated.

4 Utilizing Regional Resources and Inheriting the Regional Housing Culture

■ Assessment Item

Evaluate efforts to actively inherit the housing culture that is deeply rooted in the region as well as efforts to preserve the environment of mountain forests by utilizing wood resources of the region.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	None of Efforts to be evaluated No. 1 through 5 have been implemented.
Level 4	One of Efforts to be evaluated No. 1 through 5 has been implemented.
Level 5	Two or more of Efforts to be evaluated No. 1 through 5 have been implemented.

Efforts to be evaluated

Classification	No.	Effort
Inheritance of the local housing culture	1	A building structure, design, or techniques related to locally produced housing or gardening are employed.
	2	Gardens that represent the local community are maintained, or residential buildings that symbolize the local housing culture are preserved or restored.
	3	Locally produced materials (excluding wood produced from local mountain forests) are partly used for the structural members of the building, interior and exterior materials, or external area materials.
Utilization of locally produced wood resources	4	Wood materials produced from local mountain forests are actively used for the structure of the building.
	5	Wood materials produced from local mountain forests are actively used for the interior and exterior materials or external area materials of the building.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

In this section, an evaluation is made of efforts to inherit the regional housing culture and to preserve the regional resources of mountain forests by actively utilizing the wood resources produced in the region.

Classification of Efforts: Inheritance of the local housing culture

Efforts to actively inherit the housing style and living environment that have developed in the natural environment and climate of the region are evaluated.

1 Housing patterns, construction methods, designs, and techniques (e.g., *machiya* [traditional tradesmen's houses in Kyoto], okiyane [a type of roof erected over traditional storehouses], private houses built in the *kabutozukuri* style [with a helmet-shaped roof], etc.) that form the heritage of the region or are deeply rooted there are evaluated. Efforts made with respect to the arrangement of the garden, external area, and planting plan are also evaluated.

2 The preservation and restoration of gardens and historic buildings that symbolize the housing culture of the region are evaluated. The preservation and restoration of long-lived large trees and historical places in the region are also evaluated.

3 Materials that have regional characteristics are those that originate in the region, such as those traditionally used in the local district and region and those supplied by local industries.
Efforts to make the color of buildings and structures unobtrusive and harmonious by using materials widely

available in the region are evaluated. Efforts to enhance harmony with the existing townscape and those that activate industries supporting the housing culture of the region are also evaluated. As examples of efforts that contribute to creation of the landscape by using materials and exterior materials and fences with regional characteristics, residential areas built using granite in Ashiya City (Hyogo Prefecture) and the stone-walled village of Sotodomari (Ehime Prefecture) can be cited. However, wood resources produced in the mountain forests of the region are excluded here because they are evaluated in efforts 4 and 5.

Classification of Efforts: Utilization of locally produced wood resources

Wood from mountain forests has been used in Japan as an environmentally friendly biological material for housing construction since ancient times. However, the environment of mountain forests has been deteriorating because wood resources from these forests are not being properly utilized and are therefore not being renewed as they should be, and also because the forests are not being managed well.

In addition to the objectives in "Inheritance of the local housing culture" described above, efforts to restore the mountain forest environment by utilizing wood resources produced in the mountain forests of the region are evaluated in efforts 4 and 5.

4 Efforts to use wood resources produced in the mountain forests of the region for the main frames of the house are evaluated.

5 At the same time, efforts to use wood resources produced in the mountain forests of the region for interior and exterior materials or external area materials are evaluated.

*The locality of the "materials supplied by local industries" and the region of "wood resources produced in the region" are defined as the prefecture where the planned area is located and the adjoining prefectures.
However, if the municipality in which the planned area is located has formulated measures to facilitate the use of local materials, the definition specified by the municipality is to be applied.

1 Energy Saving through Building Innovation

1.1 Control of thermal load of building

■ Assessment Item

Evaluate the capability to control the inflow and outflow of outdoor heat in order to measure the degree of reduction of energy used for heating and cooling. The assessment criteria are the same as those in "Q$_H$1.1.1.1 Ensuring thermal insulation and airtightness performance."

■ Assessment Level

Level	Criterion
Level 1	The building satisfies the requirements of Grade 1 in Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards.
Level 2	The building satisfies the requirements of Grade 2 in Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards.
Level 3	The building satisfies the requirements of Grade 3 in Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards.
Level 4	(No corresponding level)
Level 5	The building satisfies the requirements of Grade 4 in Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

The thermal insulation and airtightness performance are evaluated to determine the basic performance of the building in terms of reducing the heating and cooling load.

The criteria are in accordance with Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards, and the performance is evaluated by one of the following standards defined for each thermal insulation area zone classification.

① Year-round heating and cooling load
② Thermal loss coefficient, etc.
③ Heat transmission coefficient, etc.

See the Evaluation Method Standards of the Japan Housing Performance Indication Standards for specific values and calculation methods. Further details regarding the calculation are provided in the "Guide to Energy-Saving Standards for Houses" (IBEC). The thermal insulation area zone classifications are described in Part III, Section 3.2, "Reference Materials for Assessment."

(Reference) Section 5-1, "Energy-Saving Action Grades," of the Japan Housing Performance Indication Standards

Energy-Saving Action Grade	Extent of actions, such as thermal insulation, to reduce energy used for heating and/or cooling
Grade 4	Measures are taken to reduce energy use to a significant degree (to the extent of meeting the "Judgment Criteria for Building Owners for Energy Efficiency Standards").
Grade 3	Measures are taken to reduce energy use to a certain degree.
Grade 2	Measures are taken to reduce energy use to a small degree.
Grade 1	Other than the above

1.2 Natural energy use

■ Assessment Item

Evaluate methods to reduce energy consumption for heating and cooling by the use of natural energy such as solar radiation heat and natural wind.

Solar-heated hot-water supply is evaluated in "LR_H1.2.2.1 Hot-water supply equipment" and solar power generation is evaluated in "LR_H1.2.5.2 Solar power generation system"; they are therefore not evaluated in this section.

■ Assessment Level

Level	Criterion
Level 1	Does not satisfy the criterion of Level 3.
Level 2	(No corresponding level)
Level 3	Use of solar radiation heat can reduce heating energy by about 10%. Or use of natural wind can reduce cooling energy by about 10%.
Level 4	Use of solar radiation heat can reduce heating energy by about 20%. Or use of natural wind can reduce cooling energy by about 20%.
Level 5	Use of solar radiation heat can reduce heating energy by about 20% and also use of natural wind can reduce cooling energy by about 20%.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

In order to reduce energy consumption for heating and cooling by the use of natural energy, it is necessary to take the climatic characteristics and location of the region into account and to adequately plan the methods to be employed.

The steps for planning these methods and probable effects of the reduction of energy for heating and cooling are described in the "Design Guidelines for Self-Cycling Residences" (IBEC). The evaluation in this section is based on these guidelines.

Aside from this evaluation method, if it is possible to quantitatively estimate reductions in energy consumption for heating and cooling that can be achieved by the use of natural energy based on the climatic characteristics and location of the region, the evaluation can be made using these percentage reductions.

The evaluation methods based on the "Design Guidelines for Self-Cycling Residences" are described in "Use of Solar Radiation Heat" and "Use of Natural Wind" below. The effects of reducing heating energy are evaluated by "Effect of heating energy reduction" in the table of Step 6 in "Use of Solar Radiation Heat," and the effects of reducing cooling energy are evaluated by "Effect of cooling energy reduction" in the table of Step 3 in "Use of Natural Wind."

Use of Solar Radiation Heat:

Step 1 Confirmation of conditions for the use of solar radiation heat

To use solar radiation heat effectively, the area of the building's openings (windows, etc.), which comprises the heat-insulating and heat-collection area (hereinafter referred to as "area of heat-collection openings"), must exceed a certain level. Specifically, it is necessary to check the following two conditions and if either of them is not met, the building concerned cannot be evaluated based on "Use of Solar Radiation Heat."

Condition 1: The criterion for Level 5 should be met in "LR1.1.1 Control of thermal load of building."

Condition 2: The ratio of the area of heat-collection openings to the total area should be 10% or more. The direction of the area of heat-collection openings* should be within 30 degrees of south to the east or west.

*The "direction of the area of heat-collection openings" refers to the direction of the normal line from the area of heat-collection openings to the outside (the direction from the inside to the outside that is vertical to the straight line connecting both ends of the area of heat-collection openings).

Step 2 Selection of passive solar potential (PSP) area classification

The area in which the construction site is located is selected from among the following five types of PSP areas. These areas are classified based on their solar radiation characteristics in terms of the amount of solar radiation and air temperature during the winter season. The site classification can be selected based on the prefecture and the municipal government/ local authority list shown in Part III, Section 3.2, "(Reference 2)," in this manual.

Passive solar potential (PSP) area classification

A area:	Extremely cold area with a small amount of solar radiation
B area:	Cold area with a small amount of solar radiation
C area:	Cold area with a large amount of solar radiation
D area:	Area with a large amount of solar radiation
E area:	Warm area with a large amount of solar radiation

Step 3 Selection of location classification by effect of sunlight obstruction

The collection and use of solar radiation heat is related to the effect of the obstruction of sunlight over the building; i.e., the hours of sunlight shining on the building. Here, the locations are classified into the following three categories based on the degree of the sunlight obstruction.

Classification of location by the effect of sunlight obstruction

Classification	Degree of sunlight obstruction	Indication of hours of sunlight (at winter solstice)
Location 1	Area with a large effect of sunlight obstruction (approx. 50%) and difficulty using solar radiation heat	3 hours or more (e.g., only 3 hours of sunlight from 10:30 to 13:30)
Location 2	Area with a small effect of sunlight obstruction (approx. 25%) and capability of using solar radiation heat	5 hours or more (e.g., 5 hours of sunlight from 9:30 to 14:30)
Location 3	Area with no effect of sunlight obstruction (0%) and easy use of solar radiation heat	All-day sunlight use

*Degree of sunlight obstruction (%) indicates the ratio of the amount of solar radiation that cannot be used because of buildings blocking the solar radiation to the amount of solar radiation that can be used without any obstruction from buildings (the total amount of solar radiation) during the daytime (around 8:00-17:00) in the winter season.

As a rule, the hours of sunlight on a building are confirmed using sun-shadow diagrams, etc. However, a location can be determined to be "Location 3" without confirmation if the south side of the building borders on a street or a park and therefore it is obvious that the building receives sunlight all day.

Step 4 Selection of direction classification of building

The collection and use of solar radiation heat is significantly related to the direction that the area of heat-collection openings is facing. Regardless of the area classification, the direction of the area of heat-collection openings of the building targeted for heat collection must be within 30 degrees of due south to the east or west in order to have an effect in terms of heat collection. If it is outside this range, the amount of heat collection could dramatically decrease. Two categories are set for the direction using due south as a benchmark in that range.

Direction 1: Due south ± 15°
Direction 2: Due south ± 30° (excluding the range covered by Direction 1)

Step 5 Classification of methods for use of solar radiation heat

The methods adopted for the use of solar radiation heat are classified into the following three types.

Method 1:	Thermal insulation of openings (improvement of the heat-insulating performance of the area of openings)
Method 2:	Heat collection from openings (increase of the area of heat-collection openings)
Method 3:	Heat storage (use of thermal storage material)

2

The requirements for evaluating the methods for the use of solar radiation heat are as follows:

Method	Requirements	Remarks
Method 1	The coefficient of heat transmission of every opening is not more than 2.91 W/m^{2}K.	Specification examples: • Sash made of wood or plastic + multi-glazed (A6) glass • Heat-blocking sash made of metal + low-radiation multi-glazed (A12) glass
Method 2	The area of heat-collection openings is not less than 20% of the total area.	Openings that can serve as heat-collection areas facing due south ±30º are evaluated.
Method 3	Materials that can be expected to increase heat capacity to 120 kJ/°Cm^2 or more are used for the heat-collection area.	The heat capacity is calculated by: Heat capacity (kJ/°Cm^2) = Capacity of heat-collection area (m^3) x Volumetric specific heat of thermal storage material (kJ/m^3°C) / Area of heat-collection area (m^2)

*To obtain a substantial energy reduction effect, attention should also be paid to various points other than the above techniques. For specific design methods, refer to the "Design Guidelines for Self-Cycling Residences."

Step 6 Effect of heating energy reduction by use of solar radiation

On the basis of the above classifications-namely, the PSP area, location, direction, and method classifications-the effect of heating energy reduction is estimated from the table below. Any combination of the methods listed in the table is acceptable.

Passive solar potential (PSP) area classification	Effect of heating energy reduction	Applied methods				
		Location 3		Location 2		Location 1
		Direction 1	Direction 2	Direction 1	Direction 2	
A area B area	Approx. 10%	Method 1 Method 1 + 2 Method 1 + 3	Method 1 Method 1 + 2 Method 1 + 3 Method 1 + 2 + 3			
	Approx. 20%	Method 1 + 2 + 3				
C area	Approx. 10%	Method 1	Method 1	Method 1 + 2 + 3	Method 1 + 2 + 3	
	Approx. 20% or more	Method 1 + 2 Method 1 + 3 Method 1 + 2 + 3	Method 1 + 2 Method 1 + 3 Method 1 + 2 + 3			
D area E area	Approx. 10%	Method 1	Method 1	Method 1 + 2	Method 1 + 2 + 3	
	Approx. 20% or more	Method 1 + 2 Method 1 + 3 Method 1 + 2 + 3	Method 1 + 2 Method 1 + 3 Method 1 + 2 + 3	Method 1 + 2 + 3		

*An area classified as Location 1 is not subject to evaluation as no heating effect can be expected from methods using solar radiation heat.

Use of Natural Wind:

Step 1 Selection of location classification

The availability of natural wind may change and the effective method for energy saving may differ according to the conditions of the area surrounding the site, such as whether there is a building blocking the prevailing wind on the windward side of the house to be built. Here, to evaluate the use of natural wind, the location requirements are classified into the following three categories:

Location 1:	Overcrowded/multistoried area in which it is difficult to use natural wind
Location 2:	Overcrowded area where some efforts are necessary to use natural wind
Location 3:	Suburban area where natural wind is easily used

Step 2 Classification of methods of natural wind use

The methods adopted for natural wind use are classified into the following five methods:

Method 1:	Direct intake of natural wind
Method 2:	Indirect intake of natural wind
Method 3:	Intake of natural wind by using a roof surface

Method 4:	Use of ventilation employing temperature difference
Method 5:	Enhancement of indoor draft performance

Examples of methods of design for natural wind use are shown below. Although these designs are not requirements for evaluation, unlike the use of solar radiation heat, they can be used as standards to judge whether the method in question corresponds to one of the above methods.

Method	Examples of design for natural wind use
Method 1	• Check the direction of the prevailing wind. Inspect the difference in wind pressure on the wall surface and roof surface, and set up two or more openings effective for drafts in places where a large difference in wind pressure can be observed.* • Design the house so that rooms expected to have good ventilation are placed on the windward side. • Ensure the appropriate area of openings.
Method 2	• Check the direction of the prevailing wind. Set sunrooms and bay windows on the wall where the prevailing wind flows and set up openings on the windward side. • Check the direction of the prevailing wind. Set openings on the wall where the prevailing wind flows. Increase the wind pressure in that area by setting fences, plants, side walls, etc.
Method 3	• Check the areas where the wind pressure coefficient is negative on the roof surface and place roof skylights and top windows, etc. there.
Method 4	• Place windows in high areas and low areas where there is sufficient difference in elevation to ensure ventilation caused by temperature difference. • Place a large window in the high area. • Place roof skylights, top windows, ventilation outlets, etc. as windows in the high area.
Method 5	• Ensure as much open space as possible and use equipment (sliding doors, transoms, latticed sliding doors, doors with openings, etc.) for better wind flow.

*To obtain a substantial energy reduction effect, attention should also be paid to various points other than the above techniques. For specific design methods, refer to the “Design Guidelines for Self-Cycling Residences.”

2

Step 3 Effect of cooling energy reduction by use of natural wind

The effect of cooling energy reduction is determined from the table below based on the above location and method classifications.

Effect of cooling energy reduction	Applied methods		
	Direction 1	Direction 2	Direction 3
Approx. 10%	Method 4 + 5	Method 2 + 3 + 5	Method 1 + 5
Approx. 20% or more		Method 2 + 3 + 4 + 5	Method 1 + 2 + 5

(Reference) The above standards can be replaced as follows using the target levels in the "Design Guidelines for Self-Cycling Residences."

Level	Criterion
Level 3	Accomplish Target Level 2 in “3.4 Use of Solar Radiation Heat” or Target Level 1 in “3.1 Use of Natural Wind”
Level 4	Accomplish either Target Level 3 in “3.4 Use of Solar Radiation Heat” or Target Level 2 in “3.1 Use of Natural Wind.”
Level 5	Accomplish both Target Level 3 in “3.4 Use of Solar Radiation Heat” and Target Level 2 in “3.1 Use of Natural Wind.”

*The numbers in the table indicate the sections in the above guidelines.

2 Energy Saving through Equipment Performance

2.1 Air-conditioning systems

2.1.1 Heating system

■ Assessment Item

Evaluate measures to reduce the heating energy consumption of the heating system.

■ Assessment Level

Level	Criterion
Level 1	No special effort is made in an integrated space including the living room.
Level 2	(No corresponding level)
Level 3	A heating system whose equipment efficiency is of a general level is used in an integrated space including the living room.
Level 4	(No corresponding level)
Level 5	A heating system whose equipment efficiency is high is used in an integrated space including the living room.

Availability of conditions for adding points:
*None
Level change according to conditions:
*When it is determined in "Q_H1.1.3.1 Proper planning for heating" that the house concerned has no need for a heating system and there is no plan to install a heating system, it is evaluated as Level 5.
Assessment not applicable:
*None

■ Description

The equipment to be evaluated is a heating system in an integrated space including the living room, which is the same as that evaluated in "Q_H1.1.3.1 Proper planning for heating."

Level 1: It cannot be determined that the equipment efficiency is equivalent to Level 3 or Level 5, or it is unknown.

Level 3: When a heating system with average equipment efficiency is used, it is evaluated as Level 3.
The standards for Level 3 are described below.

When the heating system is the same as that evaluated in "LR_H1.2.1.2 Cooling system" below (i.e., a combined cooling and heating system):
- A system evaluated as Level 3 in "LR_H1.2.1.2 Cooling system" is used.

When the heating system is different from that evaluated in "LR_H1.2.1.2 Cooling system":
- A hot-water floor-heating/hot-water heating system with heat-source equipment evaluated as Level 4 in "LR_H1.2.2.1 Hot-water supply equipment" is used.
  If the heat-source equipment is exclusively used for floor heating, and the equipment efficiency is equivalent to that evaluated as Level 4 in "LR_H1.2.2.1 Hot-water supply equipment."
- Combustion type forced-flue (FF) heater
- Combustion type semi-hermetic heater
- Electric type floor heating system
- Heat-storage type electric heater

Level 5: When a heating system with high equipment efficiency is used, it is evaluated as Level 5.
The standards for Level 5 are described below.

When the heating system is the same as that evaluated in "LR_H1.2.1.2 Cooling system" (i.e., a combined cooling and heating system):
- A system evaluated as Level 5 in "LR_H1.2.1.2 Cooling system" is used.

When the heating system is different from that evaluated in "LR$_H$1.2.1.2 Cooling system":

- A hot-water floor-heating/hot-water heating system with heat-source equipment evaluated as Level 5 in "LR$_H$1.2.2.1 Hot-water supply equipment" is used.
- Hot-water floor heating employing an electric heat pump as a heat source is used.

When it is determined in "Q$_H$1.1.3.1 Proper planning for heating" that the house concerned has no need for a heating system and there is no plan to install a heating system, it is evaluated as Level 5.

There are many different types of heating systems, including dedicated heating systems, cooling and heating systems, and hot-water-supply and heating systems, with various types of heat-source equipment and different variations of radiator. This also holds true in an integrated space including the living room where combinations of different types of heating systems are often used. When evaluating a heating system other than the above, check the equipment efficiency in its catalog, etc. and compare it with the heating systems mentioned above before performing the evaluation.

2.1.2 Cooling system

■ Assessment Item

Evaluate measures to reduce the cooling energy consumption of the cooling system.

■ Assessment Level

Level	Criterion
Level 1	No special effort is made in an integrated space including the living room.
Level 2	(No corresponding level)
Level 3	A cooling system whose equipment efficiency is of a general level is used in an integrated space including the living room.
Level 4	(No corresponding level)
Level 5	A cooling system whose equipment efficiency is high is used in an integrated space including the living room.

Availability of conditions for adding points:
*None
Level change according to conditions:
*When it is determined in "Q_H1.1.2.2 Proper planning for cooling" that the house concerned has no need for a cooling system and there no plan to install a cooling system, it is evaluated as Level 5.
Assessment not applicable:
*None

■ Description

The equipment to be evaluated is a cooling system in an integrated space including the living room, which is the same as that evaluated in "Q_H1.1.2.2 Proper planning for cooling."

Level 1: It cannot be determined that the equipment efficiency is equal to Level 3 or Level 5, or it is unknown.

Level 3: When a cooling system with average equipment efficiency is used, it is evaluated as Level 3.
The standards for average equipment efficiency are described below.

In the case of direct-blowing, wall-hanging type equipment with a cooling capacity of 4.0 kW or less: 76% or more but less than 84% of the top runner target values defined in the Act Concerning the Rational Use of Energy (refer to the following table).

In the case of equipment other than the above: 100% or more but less than 110% of the top runner target values defined in the Act Concerning the Rational Use of Energy (refer to the following table).

Target year	FY2010: Cooling & heating / wall-hanging type, 4.0 kW or less (APF Standard) → * mark in the table					
	FY2007: All air conditioners other than the above (Cooling & Heating COP Standard)					
Target standard value	Cooling & heating type	Cooling capacity	~3.2 kW	~4.1 kW	~7.1 kW	More than 7.1 kW
	Wall-hanging type	Prescribed size*	5.8	4.9	3.17	
		Free size*	6.6	6.0		
	Types other than wall-hanging type		3.96	3.20	3.12	
	Multi-type air conditioner		4.12		3.23	3.07
	Duct-connected type		3.02			

* Prescribed size: Having an indoor unit with maximum dimensions of 800 mm (width) x 295 mm (height)
* Free size: Air conditioners other than the above

Level 5: When a cooling system with high equipment efficiency is used, it is evaluated as Level 5.
When it is determined in "Q_H1.1.2.2 Proper planning for cooling" that the house concerned has no need for a cooling system and there is no plan to install a cooling system, it is evaluated as Level 5.
The standards for equipment efficiency of Level 5 are described below.

In the case of direct-blowing, wall-hanging type equipment with a cooling capacity of 4.0 kW or less: 84% or more of the top runner target values defined in the Act Concerning the Rational Use of Energy.

In the case of equipment other than the above: 110% or more of the top runner target values defined in the Act Concerning the Rational Use of Energy.

The APF and COP of the respective room air conditioners (direct-blowing/separate/wall-hanging type in the table) can be checked in the manufacturers' catalogs and the latest "Energy Conservation Equipment Catalog" issued by the Energy Conservation Center, Japan (http://www.eccj.or.jp/catalog/index.html).

If the equipment is of an older type and cannot be evaluated by the latest achievement rate, it should be evaluated as Level 1 in principle. However, it may be evaluated by an independently calculated achievement rate based on a method designated by the Top Runner Standard.

With regard to cooling equipment that is not listed in the Top Runner Standard (equipment using heat-source energy other than electricity, duct type air-conditioning systems for well-insulated and airtight houses, air conditioning employing a multifunctional heat-pump system, etc.), the equipment efficiency in terms of cooling capacity should be checked in the product catalog, etc. and it should be evaluated based on the top runner target value of a listed device having a similar cooling capacity.

■ Explanation of Terminology

COP: Coefficient of performance

COP represents the air-conditioning capacity per 1 kW of power consumption. The larger the value, the better the energy efficiency, indicating the energy-saving performance of the equipment.

APF: Annual performance factor

APF represents the air-conditioning capacity per 1 kW of power consumption when the air conditioner is operated under certain conditions based on the JIS C 9612 Standard. It has been adopted as a newly established evaluation standard for products specified in the FY2010 target year under the Act Concerning the Rational Use of Energy.

Top Runner Standard:

The Top Runner Standard is defined in the Act Concerning the Rational Use of Energy to ensure the improvement of energy efficiency of equipment. It is applied to manufacturers and importers of equipment that consumes energy, and requires them to achieve the target value of energy efficiency for that equipment. As of March 2007, 21 items have been covered and classified into categories, each having a target value of energy efficiency and a specified year by which the target is to be met.

2.2 Hot-water equipment

2.2.1 Hot-water supply equipment

■ Assessment Item

Evaluate measures to reduce the energy consumption of the hot-water supply equipment.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	Other than below
Level 3	Electric water heater (electrically controlled type)
Level 4	Fuel-burning, instant-supply type water heater
Level 5	Fuel-burning, latent-heat-recovery, instant-supply type water heater; electric heat-pump water heater; solar water heater; solar hot-water supply system (natural circulation type with direct heat collection, forced circulation type with direct heat collection, forced circulation type with indirect heat collection)

Availability of conditions for adding points:

*None

Level change according to conditions:

*When a gas engine cogeneration system is installed, the house should be evaluated under LR_H1.2.5.1.
When a fuel cell cogeneration system is installed, it is evaluated as Level 5.

Assessment not applicable:

*None

■ Description

When an electric water heater (other than an electrically controlled type) is installed, it is evaluated as Level 2.

An electrically controlled type has the function of controlling the starting time of energization, which is calculated based on the required duration of energization obtained by estimating the amount of heat needed to heat the water to the required temperature and the set water level by sensing the temperature of the supplied water and other conditions. The manufacturer's catalog should be checked to determine the status of the function.

When a fuel cell cogeneration system is installed in the house, the evaluation "No effort made" is given in "LR_H1.2.5.1 Home cogeneration system" (refer to the description in LR_H1.2.5.1 for the reason), but the fuel cell cogeneration system is given an evaluation of Level 5 as hot-water supply equipment.

2.2.2 Heat insulation of bathtub

■ Assessment Item

Evaluate measures to reduce energy consumption for hot-water supply through heat insulation of the bathtub.

■ Assessment Level

Level	Criterion
Level 1	In the case of a noninsulated bathtub having a part that is exposed outside the insulated envelope of the house
Level 2	(No corresponding level)
Level 3	In the case of a noninsulated bathtub whose parts are inside the insulated envelope of the house or an insulated bathtub having a part that is exposed outside the insulated envelope
Level 4	(No corresponding level)
Level 5	In the case of an insulated bathtub whose parts are inside the insulated envelope of the house

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*If there is no bathtub.

■ Description

When a bathtub is unable to efficiently retain the heat of hot water with which it is filled, it becomes necessary to reheat the water, leading to an increase in energy consumption for hot-water supply. To evaluate this point, bathtubs are classified into several levels by a combination of the presence or absence of bathtub heat-insulating performance on the one hand, and the positional relationship between the bathtub and the outer surface of the house's heat insulation. The presence or absence of bathtub heat-insulating performance depends on whether the bathtub meets the following standard:

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Standard for determination of the presence or absence of bathtub heat-insulating performance:

When the outside air temperature is around 5℃, it takes 4 hours or more for the temperature of hot water in the bathtub (approx. 42℃) to drop to 2℃.

The bathtub is classified according to the type of bathroom. If there are two or more bathrooms, the most frequently used bathroom is evaluated.

Bathroom built using conventional construction method

As a general rule, the bathtub should be evaluated as a noninsulated type. Although bathrooms built using the conventional construction method (wet construction method) are commonly used today, heat loss can be expected as the bathtub is exposed to the blocks, mortar, or concrete with which it comes into contact. This holds true for houses with outside insulation construction and the installation of a floor type bathtub. A bathtub in a bathroom built using the dry conventional construction method employing panels as part of the materials should also be evaluated as a noninsulated type. However, if it is confirmed that the standard for determination of the presence or absence of bathtub heat-insulating performance is satisfied, it should be evaluated as an insulated bathtub.

Prefabricated bathtub (The distinction between insulated and noninsulated types is described later.)

① Noninsulated type prefabricated bathtub

If the bathtub is noninsulated, it should be evaluated as a noninsulated type. If the bathroom is located on the first floor and the bathtub is exposed to the outside of the insulated underfloor of the house, it is evaluated as Level 1.

On the other hand, if the bathtub is installed inside the insulated envelope of the house, it is evaluated as Level 3.

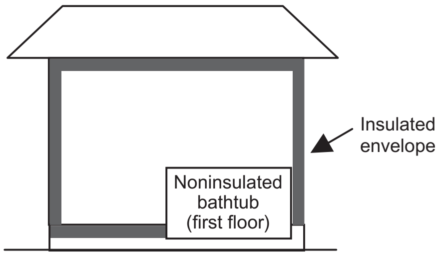
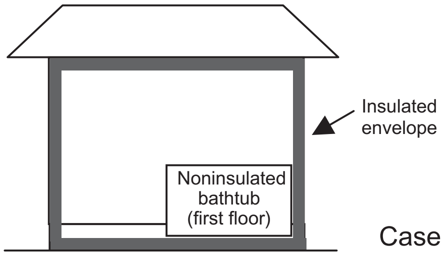
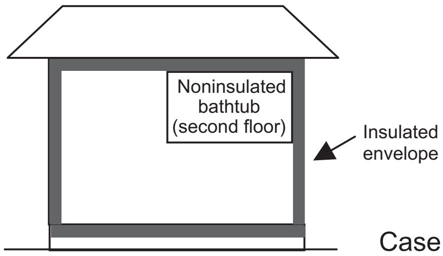
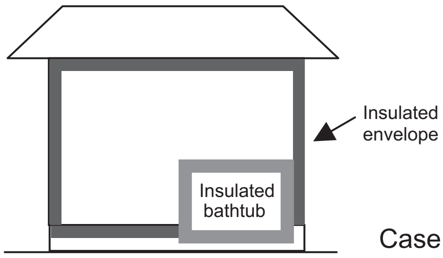
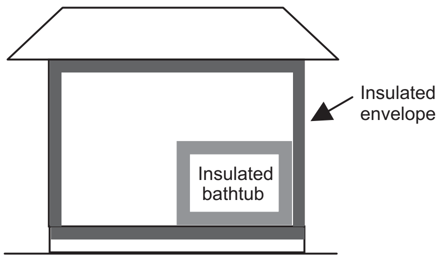
② Insulated type prefabricated bathtub

If the bathtub is insulated, it should be evaluated as an insulated type. If the bathtub has high heat-retention performance, is located on the first floor, and is exposed to the outside of the insulated underfloor, it is evaluated as Level 3.

If the bathtub is installed inside the insulated envelope of the house, it is evaluated as Level 5 since it has double insulated layers.

Moreover, if the standard for determination of the presence or absence of bathtub heat-insulating performance is ensured not only for the bathtub but also for the bathroom, the criterion can be switched from an insulated type bathtub to an insulated type bathroom.

(Reference 1) Assessment Level Based on the Relationship between the Bathtub and Insulated Envelope of the House

Level	Diagrammatic illustration	Description
Level 1		When the insulated envelope is installed on the floor of the first floor, a noninsulated bathtub set as shown in the illustration will be exposed to the area outside the insulation, resulting in a decrease in heat-insulating performance. Therefore, it is evaluated as Level 1.
Level 3	 Case 1  Case 2  Case 3	When the insulated envelope is installed at the bottom of the foundation and a noninsulated bathtub is set on the first floor (Case 1) or second floor (Case 2), the bathtub is situated inside the insulated envelope, so that heat-insulating performance exceeding that of Level 1 is expected. When an insulated type bathtub is set outside the insulated envelope on the first floor (Case 3), good heat-insulating performance is still expected due to the insulating property of the bathtub itself. For the reasons mentioned, the above cases are evaluated as Level 3.
Level 5		When an insulated type bathtub is set inside the insulated envelope, the heat-insulating performance is expected to improve to a higher degree than Level 3; therefore, it is evaluated as Level 5.

(Reference 2) General Specifications of Insulated Type Prefabricated Bathtubs (as of September 2007)

Insulation of bathtub
Consideration is given to the heat-insulating performance of the bathtub, as seen in bathtubs fitted with insulating material (expanded-foam type or vacuum-insulating materials, etc.).

Insulation of bathtub cover
Consideration is given to the heat-insulating performance of the bathtub cover, as seen in bathtub covers whose inside surface is covered with insulating material (expanded-foam type or vacuum insulating materials, etc.).

Insulation of waterproof pan
Consideration is given to the heat-insulating performance of the bathroom, as seen in bathrooms where an insulating sheet is installed at the bottom of the waterproof pan, or the back of the waterproof pan is covered with heat-insulating material (expanded-foam type materials, etc.).

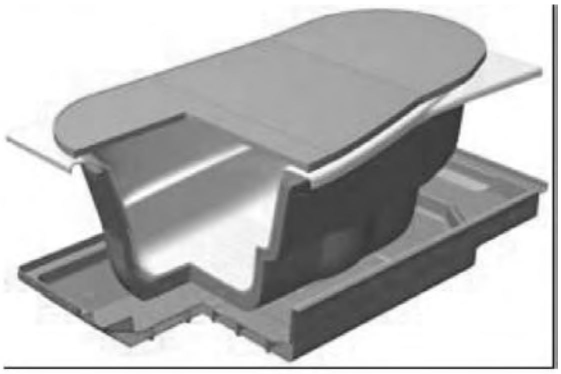
Insulation of wall/ceiling panels
Consideration is given to the heat-insulating performance of the bathroom, as seen in bathrooms where the backs of the panels are covered with insulating material (expanded-foam type materials, etc.), or an insulating sheet.

(Reference 3) Images of Various Types of Bathrooms

Bathroom built using the conventional construction method

Structural view of a noninsulated type prefabricated bathtub

Structural view 1 of an insulated type prefabricated bathtub



Structural view 2 of an insulated type prefabricated bathtub

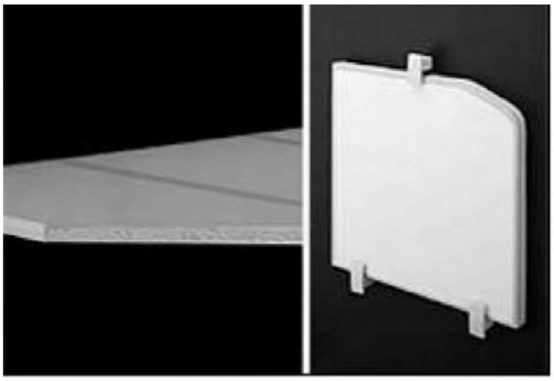


Diagram of an insulated bathtub cover

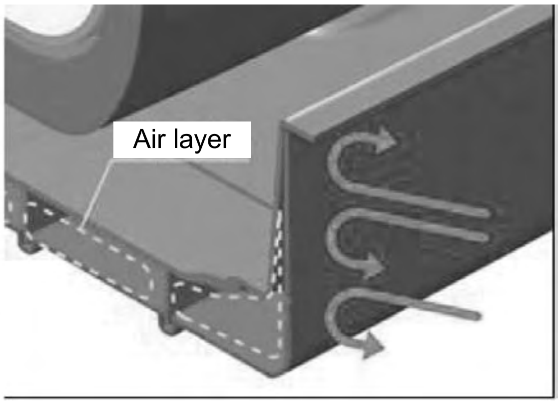


Diagram of the insulating sheet of a waterproof pan

2.2.3 Hot-water plumbing

■ Assessment Item

Evaluate measures to reduce energy consumption for hot-water plumbing and reheating plumbing.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	When front-end-branching type hot-water piping is used
Level 3	When header type hot-water piping is used
Level 4	(May be selected if the Conditions for adding points are met.)
Level 5	(May be selected if the Conditions for adding points are met.)

Availability of conditions for adding points:
*Available
Level change according to conditions:
*None
Assessment not applicable:
*None

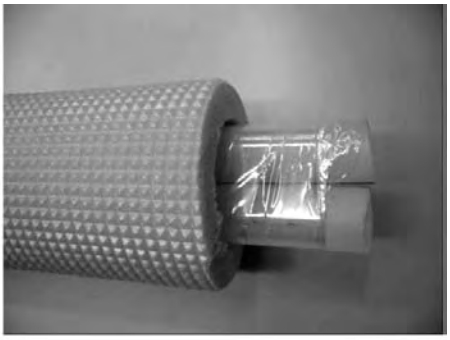
■ Description

If header type hot-water plumbing is used, normally the diameter of piping leading from the header to the equipment in the house can be reduced. There is also less wastage of hot water compared with the front-end-branching type. Therefore, the use of front-end-branching type hot-water plumbing is evaluated as Level 2 and that of header type hot-water plumbing is evaluated as Level 3. Moreover, both types can be evaluated as a maximum of Level 5 through the addition of points by satisfying the following requirements:

Conditions for adding points:
The rating will be raised by one level for each of the following conditions that is met:
1) If the length of the hot-water piping from the part that penetrates the insulated envelope of the house to the hot-water supply system is 5 m or less, or the hot-water system is installed inside the insulated envelope, the rating can be raised by one level.
2) If the hot-water piping from the part that penetrates the insulated envelope of the house to the hot-water supply system is insulated, the rating can be raised by one level.
3) If the entire piping for the bathtub reheating system is insulated, the rating can be raised by one level.

The insulation of piping referred to in the Conditions for adding points means that expanded foam material, etc. is used as an insulating material for the hot-water and reheating system piping. See the following examples of insulating materials and insulation-integrated type piping.

Example of cross-linked polyethylene foam (PEF) insulating material



Example of insulation-integrated type piping for reheating system (super-insulated pair tube)

2.3 Lighting fixtures, home electric appliances, and kitchen equipment

■ Assessment Item

Evaluate measures to reduce the energy consumption of lighting fixtures, electric home appliances, and kitchen equipment.

■ Assessment Level

Level	Criterion
Level 1	The score based on the following scoring chart is less than 2 points.
Level 2	(No corresponding level)
Level 3	The score based on the following scoring chart is 2 points or higher but less than 4 points.
Level 4	The score based on the following scoring chart is 4 points or higher but less than 7 points.
Level 5	The score based on the following scoring chart is 7 points.

The evaluation is performed based on the energy-saving standard achievement rate of five types of appliances in Scoring charts 1 and 2 (if an electric cooking heater, not a gas cooking stove, is installed, it is evaluated according to Scoring chart 3). The total score of the five types is determined as the score and evaluated with reference to the above table. If there are multiple units of same appliance in the house, the most commonly used appliance is selected for evaluation.

【Scoring chart 1】

Score	Lighting fixtures	Electric refrigerator
2	Energy-saving standard achievement rate: 100% or higher	Energy-saving standard achievement rate: 80% or higher
0	Energy-saving standard achievement rate: less than 100%	Energy-saving standard achievement rate: less than 80%

【Scoring chart 2】

Score	Electric toilet seat	TV		Gas cooking stove
		LCD or plasma	CRT	
1	Energy-saving standard achievement rate: 100% or higher	Energy-saving standard achievement rate: 112% or higher	Energy-saving standard achievement rate: 109% or higher	Energy-saving standard achievement rate: 100% or higher
0	Energy-saving standard achievement rate: less than 100%	Energy-saving standard achievement rate: less than 112%	Energy-saving standard achievement rate: less than 109%	Energy-saving standard achievement rate: less than 100%

【Scoring chart 3】

Score	Electric cooking heater
1	Induction heating (IH) type cooking heater (when not less than half of the cooking facilities are of the IH system)
0	Other than the above

Availability of conditions for adding points:
*None

Level change according to conditions:
*None

Assessment not applicable:
*None

■ Description

The five types of appliances rated here have been selected from among the equipment items designated as special items in the Top Runner Standard as of September 2007, since they consume large amounts of energy and are considered to be daily necessities. (Electric cooking heaters have a separate standard as they are not designated.)

Each product is given either 2 points or 1 point in terms of the energy-saving standard achievement rate set for that type of appliance, and similarly "no possession" of an appliance of interest is also given either 2 points or 1 point. However, this only applies to a case in which occupancy with no possession of the appliance is obvious, and if it is undecided, 0 points are given.

With regard to lighting fixtures, fluorescent lights used as the main lighting (i.e., among all of the lights used daily and concurrently) in an integrated space including the living room are evaluated. If there are multiple types of targeted lighting fixtures, the energy-saving standard achievement rate of the lighting fixture type among them that has the largest number of units is evaluated. If there are two or more lighting fixture types that both have the largest number of units, the lighting fixture type among them that has the highest energy-saving standard achievement rate is evaluated. However, if the main lighting fixture includes an incandescent lamp, it is evaluated as 0 points.

The evaluation is made using the latest target values in the Top Runner Standard released at the time of the evaluation. As a general rule, appliances are subject to evaluation when the achievement rate of the target value is 100% or more; however, if a product is a target for the "Unified energy conservation label," which was inaugurated in 2006, such a product with three or more stars in the multiple-stage evaluation can be scored. As of September 2007, there are three types of target products: air conditioners, refrigerators, and TV sets. They are scored when they have three or more stars and satisfy the following standards: 80% or more for refrigerators, 112% or more for TV sets of the liquid crystal display (LCD) or plasma type, and 109% or more for TV sets of the cathode ray tube (CRT) type. Other products that are newly added as target products for the Unified energy conservation label will also be evaluated according to this policy.

The energy-saving standard achievement rate for each electric home appliance should be confirmed in the manufacturer's catalog and the latest "Energy Conservation Equipment Catalog" of the Energy Conservation Center, Japan (http://www.eccj.or.jp/catalog/index.html).

If the equipment is of an older type and cannot be evaluated by the latest achievement rate, it should be evaluated as 0 points in principle. However, it may be evaluated by an independently calculated achievement rate based on a method designated by the Top Runner Standard.

Similar products whose achievement rates are not released because they are not targets of the Top Runner Standard are rated as 0 points as a rule. However, if such a product is determined to have an energy conservation performance equivalent to the standard scored by this evaluation, it can be scored.

Usually, since these appliances are brought in by the occupants, it is difficult for the housing supplier to obtain information about them. However, it was decided to incorporate them into the evaluation because they account for a significant percentage of a house's total energy consumption. Housing suppliers are recommended to inform the owners of houses about the importance of energy conservation related to these appliances.

■ Explanation of Terminology

Top Runner Standard:

Refer to the Explanation of Terminology in "LR_H1.2.1.2 Cooling system."

Energy conservation labeling system:

A labeling system to inform general consumers about the achievement level of individual products against the target value set in the Top Runner Standard.

Unified energy conservation label:

A system by which retail businesses display energy-saving information on their products. While the aim of the energy conservation labeling system is to indicate how much the target level of energy consumption efficiency is achieved, the unified energy conservation label shows the level of energy conservation performance among the same type of current products evaluated in five grades. The label currently applies to air conditioners, TV sets, and refrigerators. The more stars there are on a label, the higher the product's energy conservation performance.

Example of unified energy conservation label

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2.4 Ventilation system

■ Assessment Item

Evaluate measures to reduce the energy consumption of the ventilation system.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	An ordinary ventilation system is used.
Level 4	A ventilation system that consumes not more than 70% of the power consumed by an ordinary ventilation system is used.
Level 5	A ventilation system that consumes not more than 40% of the power consumed by an ordinary ventilation system is used.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

The annual electricity consumption of the installed ventilation system (per unit ventilation) is calculated to evaluate it by a comparison with the following standard values:

Level	Annual electricity consumption (per unit ventilation)
Level 3	More than 5 kWh/year • (m^3/h)
Level 4	5 kWh/year • (m^3/h) or less
Level 5	2 kWh/year • (m^3/h) or less

The annual electricity consumption is calculated by a formula such as that shown below. If there are two or more installed systems, the total consumption of all systems is used as the basis for calculation.

Annual electricity consumption (kWh/year • (m^3/h))
= Σ{System electricity consumption (W) × Annual system availability factor (−)} × 24 (h/day)
× 365 (days/year) ÷ {Air volume (m^3) × Number of ventilation cycles (cycles/h)} ÷ 1000.

System electricity consumption: The rated electricity consumption of the ventilation system. It is usually listed in the catalog. Contact the manufacturer if it is unknown.

Annual system availability factor: If the system is used together with natural ventilation such as in a hybrid ventilation system or if the electricity consumption changes, calculate the annual system availability factor separately and multiply it by the rated electricity consumption.

Air Volume: The air volume of the entire building. This involves the whole air volume, not only the ventilation targets prescribed under the Building Standards Act of Japan.

(Reference)

The annual electricity consumption of the current ordinary ventilation system is considered to be approximately 120 W for a house with a total floor area of 130 m^2, and this value is set as a standard. Energy consumption that is 70% or less or 40% or less than this standard value is evaluated as Level 4 or Level 5, respectively.

2.5 Highly energy-efficient equipment

2.5.1 Home cogeneration system

■ Assessment Item

Evaluate the efficient use of energy by the installation of a gas engine cogeneration system, which is one of the household cogeneration systems.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	No effort made
Level 4	A gas engine cogeneration system is introduced but the criterion of Level 5 is not satisfied.
Level 5	A gas engine cogeneration system is introduced and efficient use of energy can be expected.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

A cogeneration system is an on-site power generation system that promotes efficient energy utilization through the use of its exhaust heat for hot-water supply and heating. To evaluate whether or not such a system achieves sufficient efficiency in terms of reducing energy consumption, the matching of demand for electricity and demand for heat by the occupants with the electricity and exhaust heat, respectively, generated by the system are the principal indicators.

The demand for electricity and demand for heat are confirmed using the standards listed below. Of the two types of household cogeneration systems (the fuel cell and gas engine types), only gas engine cogeneration systems are targeted for evaluation here. If a fuel cell type cogeneration system is installed in the targeted house, it is evaluated as Level 3.

The reason for this is that fuel cell type cogeneration systems are currently at the validation stage in which data from operation in actual houses are being obtained, so such systems are still at a stage prior to installation for common use. We will therefore reexamine this type of system after monitoring its status of dissemination. At this point, it is evaluated as "no effort made."

Confirmation items to be assessed for Level 5	
① Confirmation of electricity load	Lighting fixtures, refrigerators, and a full-time ventilation system are installed. Any of the following electric appliances are installed and their total number is eight or more: Air conditioner indoor unit (A whole-house air conditioner is counted as three items.) Microwave oven, electric rice cooker, dish washer-dryer, personal computer, color TV, washing machine (including washer-dryer), toilet seat with a warm-water “Washlet” (bidet type) system
② Confirmation of heat load	The requirements of both a and b below are met: a: The number of household members is three or more. The number of household members is defined as the number of people using (living in) the house on a daily basis. b: One or more heating systems using hot water, such as a floor-heating system, is used.

If a gas engine cogeneration system is installed, evaluation in "LR_H1.2.2.1 Hot-water supply equipment" is performed as follows:

If the system is evaluated as Level 5 in this evaluation, it is also evaluated as Level 5 in "LR_H1.2.2.1 Hot-water supply equipment."

If the system is evaluated as Level 4 in this evaluation, it is also evaluated as Level 4 in "LR_H1.2.2.1 Hot-water supply equipment."

Moreover, if a fuel cell type cogeneration system is installed, it is evaluated as Level 5 in "LR_H1.2.2.1 Hot-water supply equipment."

(Reference)

A gas engine cogeneration system generates electricity when it judges that energy conservation can be actualized from the estimated the heat demand (hot-water supply and heating system demand) and electricity demand of the house.

According to "Energy Consumption for Residential Buildings in Japan" (Architectural Institute of Japan, October 2006), the average energy consumption of a three-member household is as follows: Electricity demand = 12.2 kWh/day, Hot-water demand = 13.7 kWh/day (based on approximately 470 L/day of water heated to 40℃). By adding heating demand, energy conservation efficiency using a gas engine cogeneration system can be expected. A three-member household is set as the lower limit. When there are three or more household members using the appliances that create the electricity load, the system is evaluated as Level 5.

As subsidy requirements under the subsidy system*1 for the installation of a current gas engine cogeneration system, the installation of a heating system using hot water, such as a floor-heating system, is required. Thus, a house in which a gas engine cogeneration system is installed is evaluated as Level 5 on condition that the house is eligible for a subsidy.

*1: Subsidy system to support installation of gas engine hot-water supply equipment, Japan Gas Association

Example of gas engine cogeneration system

2.5.2 Solar power generation system

■ Assessment Item

Evaluate the energy reduction effect of introducing a solar power generation system. Solar heating and solar hot-water supply are not evaluated here, as they are evaluated in "LR$_H$1.1.2 Natural energy use" and "LR$_H$1.2.2.1 Hot-water supply equipment," respectively.

■ Assessment Method

The energy-saving ratio k is calculated as follows to adjust the scores calculated in each item from LR$_H$1.2.1.1 to 2.5.1:

$$\text{Energy-saving ratio } k = \frac{\text{Energy generated by solar power generation system (GJ/year)}}{\text{Primary energy consumption of whole house (GJ/year)}}$$

The scores obtained from LR$_H$1.2.1.1 to 2.5.1 are adjusted by the following formula using the value of k:

$$\text{Score after adjustment} = \frac{\text{Score of each item}}{(1.0 - k)}$$

*However, the number of adjusted points is up to +5 points (if k ≧ 1, each item is given 5 points).

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*If there is no solar power generation system, evaluate the house as k = 0.

2

■ Description

A solar energy generation system is a system that can generate the power consumed by the house, and any surplus electricity that it generates can be sold. The entire amount of electricity generated including the electricity to be sold is considered as the targeted reduction of energy consumed by the whole house and evaluated.

First, the annual amount of energy generated by the solar power generation system and the annual amount of primary energy consumption of the whole house (not limited to electricity) are calculated, and the ratio of the former amount to the latter amount is calculated to give the energy-saving ratio k. This indicates the extent to which the solar power generation system can cover the energy consumption of the house, with a larger value representing a larger effect.

Second, the results of the evaluations in all items (LR$_H$1.2.1.1 to 1.2.5.1) of "LR$_H$1.2 Energy Saving through Equipment Performance" are augmented using the value of k. For example, if LR$_H$1.2.1.1 is given 3 points (Level 3) and the value of k is 0.6, the corrected score is 3 / (1 - 0.6) = 7.5. Since the maximum possible score is 5, the score is corrected to 5. If the value of k is equal to or greater than 1, every result is corrected to 5 points.

The methods of calculating the amount of energy generated by the solar power generation system and the amount of primary energy consumption of the whole house, which are necessary in order to obtain the value of k, are described below. If any other appropriate method of making these calculations is available, it can also be used.

How to calculate the amount of energy generated by the solar power generation system:

An easy method is to use the power generation estimation service provided by the manufacturer of the solar power generation system, if available, or the amount of electricity generated in the nearest major city can be selected from the list in Table 2.5. The table shows the values for 1 kW, 3 kW, and 4 kW systems. Values for systems with a capacity other than 1 kW, 3 kW, or 4 kW can be calculated by simply multiplying the value shown for 1 kW by the capacity of the system concerned. The values in Table 2.5 were obtained under the conditions of a south-facing system with a 30° angle of inclination. If the conditions of the system concerned differ from these conditions, refer to Figures 2.21 and 2.22 and correct the amount of power generation accordingly.

A more detailed method is to calculate the value using the database of solar radiation flux values released by the New Energy and Industrial Technology Development Organization (NEDO) ("MONSOLA00 (801)" database of solar radiation flux by direction/angle of inclination at 801 points nationwide).

(Example) Osaka, east-facing, 20 ° angle of inclination, 3 kW
30.6 GJ x 80% x 98.4% = 24.1 GJ

Table 2.5 Annual production of electricity in major cities (Unit: GJ, Primary energy equivalent)

City	System capacity			City	System capacity		
	1 kW	3 kW	4 kW		1 kW	3 kW	4 kW
Tokyo	9.7	29.2	39.0	Osaka	10.2	30.6	40.7
Sapporo	9.5	28.5	38.0	Matsue	9.6	28.9	38.5
Kanazawa	9.5	28.5	38.0	Hiroshima	9.9	29.6	39.4
Shizuoka	10.8	32.4	43.3	Takamatsu	10.8	32.5	43.4
Nagoya	10.7	32.1	42.7	Fukuoka	9.8	29.4	39.2
Kyoto	9.7	29.0	38.6	Kagoshima	10.4	31.2	41.6

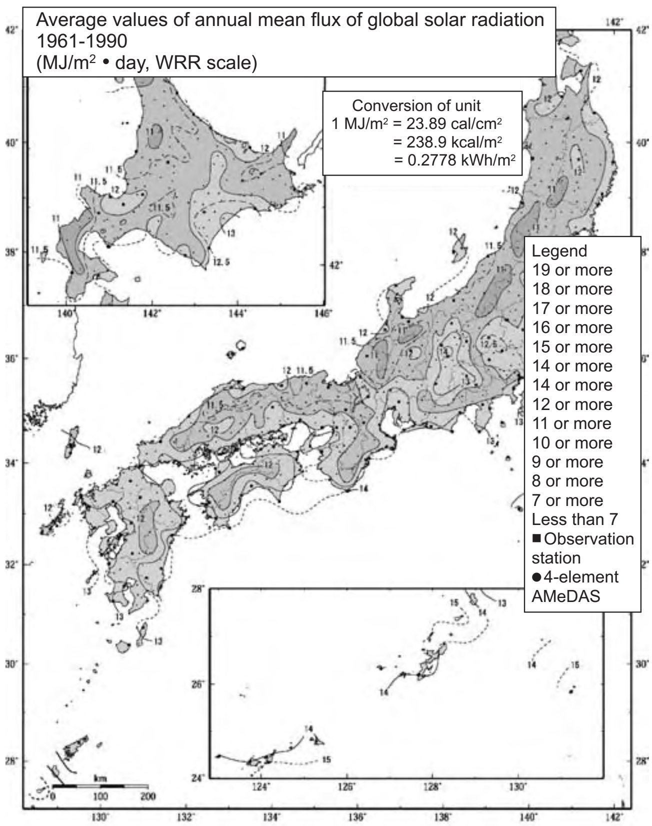
*1 The values in Table 2.5 were calculated using the MONSOLA00 Database of NEDO. The direction is 0 ° (south), and the angle of inclination is 30 °. Decrease in electricity generation due to the accumulation of snow is not taken into consideration.

*2 The values in Table 2.5 are reference values denoting the primary energy equivalent. The following formula can be used to convert the values into the amount of electricity generation in terms of secondary energy equivalent (unit: kWh):

1 GJ = 1/9.83 MWh
= 101.7 kWh

For example, the value of 29.2 GJ for a 3 kW system in Tokyo can be converted as follows:

29.2 x 101.7 = 2970 kWh



Source: "Data Map associated with Nationwide Solar Radiation," FY1998, NEDO homepage

Figure 2.20 (Reference) Average values of annual mean flux of global solar radiation

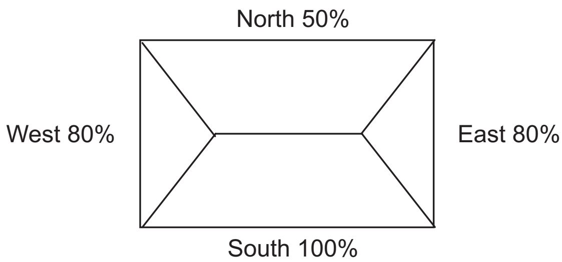
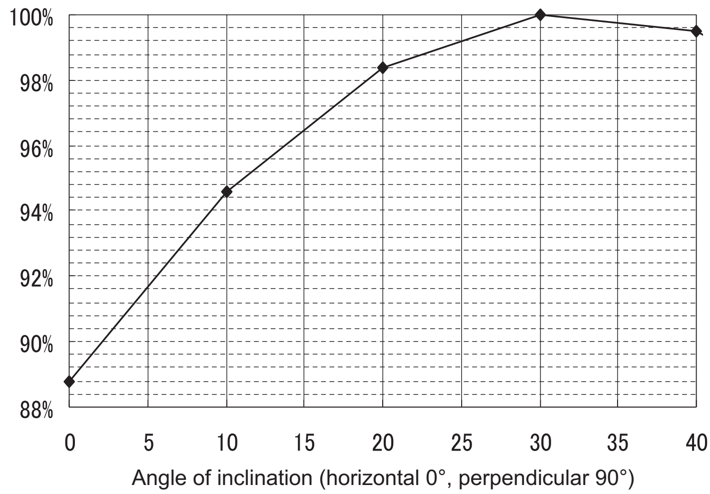


Figure 2.21 Correction factor by the direction of installation of photovoltaic power generation panels



(Reference)

Gradient	Angle of inclination	Correction factor
Horizontal	0°	88.8%
2.5 *sun*	14.0°	96.1%
3 *sun*	16.7°	97.1%
3.5 *sun*	19.3°	98.1%
4 *sun*	21.8°	98.7%
4.5 *sun*	24.2°	99.1%
5 *sun*	26.6°	99.5%
5.5 *sun*	28.8°	99.8%
6 *sun*	31.0°	99.9%

* 1 *sun* = approx. 3.3 cm.

Figure 2.22 Correction factor by the angle of inclination of photovoltaic power generation panels

How to calculate the amount of primary energy consumption of the whole house:

As the amount of energy consumption will differ according to the conditions of the location, specifications of the house, and lifestyle of the occupants, each condition of the house concerned should be taken into consideration when making the evaluation. Although it is recommended that the amount for each house be estimated individually, the values for average houses shown in Table 2.6 can be used for calculation.

Table 2.6 Average energy consumption for detached houses (amount of primary energy; unit: GJ/yearÅEhousehold unit)

Total floor area: 125 m^2

	Area I	Area II	Area III	Area IV	Area V	Area VI
Heating system	66.190	44.963	34.469	18.711	12.381	0
Cooling system	0	0.204	1.316	3.999	4.057	10.374
Hot-water supply	14.913	17.962	18.071	16.892	13.770	10.187
Lighting	10.867	10.867	10.867	10.867	10.867	10.867
Others	29.639	30.766	32.495	32.640	31.334	30.763
Total	121.609	104.762	97.218	83.109	72.409	62.191

Source: Conditions for calculating primary energy consumption in the Project for Promoting the Introduction of High-Efficiency Housing/Building Energy Systems, NEDO (FY2006)

3 Water Conservation

3.1 Water-saving systems

■ Assessment Item

Evaluate measures for the reduction of water supply consumption by means of water-saving systems.

■ Assessment Level

Level	Criterion
Level 1	No effort made
Level 2	(No corresponding level)
Level 3	One of the Efforts to be evaluated has been implemented.
Level 4	Two or more of the Efforts to be evaluated have been implemented.
Level 5	Three or more of the Efforts to be evaluated have been implemented.

Efforts to be evaluated

No.	Effort
1	Water-saving type toilet (equipped with flushing mode switchover function; flushing water volume: 8 L/flush for solid waste and 6 L/flush for liquid waste)
2	Bathroom thermostat type water faucet plus water-saving shower head equipped with hand-operated water-shutoff mechanism
3	Dishwasher
4	Other water-saving methods (water faucet designed to allow easy adjustment of water volume or equipped with water-shutoff mechanism)

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

The use of water-saving systems in lavatories, bathrooms, kitchens, and washrooms is evaluated.

Even when multiple units of the same type of system are installed, each system should be evaluated. In a case where there are two lavatories in the house and a water-saving type toilet is installed in each of them, it is considered that two efforts have been made. Easy water volume adjustment and/or faucets with a water-shutoff mechanism, etc. can be evaluated in addition to the arrangements listed above.

The setting of the flushing water volume in water-saving type toilets should comply with the Environmentally Symbiotic Housing Certification Criteria (2006 edition) (IBEC).

(Reference 1) Chapter 2, Mandatory Requirements (Water-Saving), Environmentally Symbiotic Housing Certification Criteria (2006 edition)
Toilets installed in environmentally symbiotic housing shall use 8 liters or less of water for solid waste and 6 liters or less for liquid waste when the flushing water volume is indicated, or 6 liters or less for solid waste and 4 liters or less for liquid waste when the tank water volume is indicated.

(Reference 2) Example of Estimation of Water-Saving Effect of Each Effort

No.	Effort	Assumed annual amount of water saving for 4-member household
1	Water-saving type toilet	38 m^3 (50% less)
2	Bathroom thermostat type water faucet plus water-saving shower head equipped with hand-operated water-shutoff mechanism	31 m^3 (35% less)
3	Dishwasher	93 m^3 (83% less)

3.2 Rainwater use

■ Assessment Item

Evaluate measures for the reduction of water supply consumption by rainwater use.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	No effort made
Level 4	A rainwater tank that stores rainwater for use in watering, etc. is installed.
Level 5	A rainwater utilization system equipped with a system to clean water for use as toilet flushing water, etc. is installed.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

The subject of this evaluation is a rainwater tank designed to be connected to a rain gutter for the intake of water. Such a tank may be evaluated as Level 4 or Level 5 based on the following criteria:

Level 4: The rainwater tank has a capacity of 80 L or more.

2

Level 5: All of the following conditions are satisfied:

- ⇒ Water purification is performed as required for the purpose of use.
- ⇒ The quantity of water supply to the house is reduced 10% or more.
- ⇒ Rainwater is used not only for irrigation but also for daily use inside the house such as for flushing toilets, etc.

*Source: Section 2-5, "Highly Effective Use of Water Resources," "Proposed Types," Environmentally Symbiotic Housing Certification Criteria 2006 (IBEC)

4 Well-Informed Maintenance and Operation Schemes

4.1 Presentation of lifestyle advice

■ Assessment Item

Evaluate the extent to which information to promote an energy-saving lifestyle has been given to the occupants.

■ Assessment Level

Level	Criterion
Level 1	No effort made
Level 2	(No corresponding level)
Level 3	An operating manual for each item of equipment has been given to the occupants.
Level 4	In addition to Level 3 compliance, general instructions on an energy-saving lifestyle have been given to the occupants.
Level 5	In addition to Level 3 compliance, appropriate instructions for each individual building or lifestyle have been given to the occupants with respect to utilities, equipment, and specifications incorporated in or implemented for the building.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

Actualization of the effects of energy-conservation type buildings and equipment depends on how the systems are used. In this section, information given to the occupants to promote an energy-saving lifestyle is evaluated.

For Level 3 compliance, the evaluation is made that instruction manuals for the systems incorporated into the building, such as the hot-water supply system, have been handed over to the occupants. With these instructions in hand, the occupants are able to carry out the appropriate maintenance and seek better energy consumption efficiency by maintaining the equipment performance.

Example of an effort for Level 4 compliance:
Providing the occupants with explanations about an energy-saving lifestyle using brochures released to the public, including "Guide to Intelligent Lifestyles" issued by the Energy Conservation Center, Japan.

"Guide to Intelligent Lifestyles" (in Japanese) can be downloaded from the following website (as of September 2007):
http://www.eccj.or.jp/pamphlet/living/06/index.html

Example of an effort for Level 5 compliance:
Providing the occupants with detailed information as appropriate according to the individual conditions of the house, such as the operating principles and effective use of the installed systems and their specifications. For example, when a passive ventilation system has been installed, detailed explanations are necessary according to the locational conditions, including the design concept of the house concerned and when to open which openings in order to realize effective ventilation.

4.2 Management and control of energy

■ Assessment Item

Evaluate measures for the reduction of energy consumption by management and control of energy.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	No effort made
Level 4	Equipment on which energy consumption is indicated or load-reducing equipment is used.
Level 5	An energy management mechanism has been put in place, and measures are taken to realize the reduction of energy consumption based on the use of this mechanism.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

For evaluation as Level 4, one of the following measures must be taken:

a. Equipment that indicates consumption of electricity, gas, or water is installed. (Any display format for the consumption is acceptable, such as amount of energy, energy cost, etc.)
b. Separate systems attached to a terminal, such as an electrical outlet, gas cock, etc., that indicates electricity or gas consumption are used.
c. A distribution switchboard equipped with a function to cut off branch circuits according to the status of power consumption (distribution switchboard with a peak cutoff function) is installed.

Evaluation as Level 5 requires the use of equipment equivalent to the energy consumption indicators registered under the "Energy Conservation Navigation" system, which control energy by setting the limits of energy consumption. Moreover, the following condition should be concurrently met:

a. The control equipment is equipped with a function to simultaneously suspend the operation of two or more items of equipment with large energy consumption in the house (air-conditioning systems such as room air conditioners and floor heating, lighting, and hot-water supply) according to the status of energy consumption.

*Conditions for equipment registered under Energy Conservation Navigation system (excerpt)
(For the latest information, refer to the website of the Energy Conservation Center, Japan:
http://www.eccj.or.jp/navi/index.html)

◇ Power consumption and energy-saving target consumption can be calculated in the form of monetary values.
◇ Users can set a fee structure and target values.
◇ Accuracy of measurement is within Å}5% in each measurement range.
◇ Measurement results can be displayed immediately (within 5 minutes).
◇ Visual display is available.
◇ Others

In conceptual terms, the targeted system evaluated as Level 5 is a mechanism that automatically controls the systems and equipment installed in a house based on the results of monitoring of the energy consumption and room environments in real time, which is now under development. This is commonly referred to as the "Home Energy Management System (HEMS)"; however, the definition of HEMS has not yet been established and therefore the above conditions are used for evaluation.

(Reference) Examples of Energy Consumption Indicators

Remote controller indicating energy consumption

Indicator registered under Energy Conservation Navigation system

The status of consumption of energy such as electricity and gas, as well as water, etc., is displayed on remote controllers. The occupants can thereby become aware of energy consumption and are expected to promote energy-saving behavior.

The figure above shows an example of a remote controller for a fuel cell, on which the power generation of the fuel cell and amount of electricity purchased are indicated so that the users can check the electricity consumption in the house. If such a system that allows energy consumption to be checked is installed, the house is evaluated as Level 4. Moreover, if the energy consumption of hot-water supply equipment is large and a function with which the consumption can be checked is available, it is also evaluated as Level 4.

When a function to control the target consumption of energy among the functions registered under the Energy Conservation Navigation system is used, enhancement of activities for energy conservation can be expected.

If only an indicator registered under the Energy Conservation Navigation system is installed, the house is evaluated as Level 4. However, if the indicator incorporates a function that can simultaneously suspend the operation of two or more items of equipment with large energy consumption, it is evaluated as Level 5, provided that the equipment has a function by which it can be remotely controlled by the occupants from inside and outside the house.

1 Introduction of Materials Useful for Resource Saving and Waste Prevention

1.1 Building frames

■ Assessment Item

Evaluate efforts related to the introduction and reuse of materials in the building frames that are useful for resource saving (recycled materials, renewable materials) and waste prevention (recyclable materials).

■ Assessment Level

Level	Criterion
Level 1	The evaluation is conducted using the detailed items in "LR$_H$2.1.1.1 Wooden house," "LR$_H$2.1.1.2 Steel-frame house," or "LR$_H$2.1.1.3 Concrete house."
Level 2	
Level 3	
Level 4	
Level 5	

■ Description

This evaluation is conducted using the detailed items appropriate for the structure of the house ("1.1.1 Wooden house," "1.1.2 Steel-frame house," or "1.1.3 Concrete house"). In the case of a house with a mixed structure, the evaluation is conducted for each of the structures separately, and a weighted average of the assessment levels is obtained according to the respective floor areas. If the result is not a whole number, the assessment level is obtained by rounding it off to the nearest whole number.

*When the evaluation is conducted using the software, the assessment results for a mixed structure are input only in one of the columns; i.e., the column for the structure with the largest area. (With respect to the columns for the other two structures, choose "Excluded.")

2

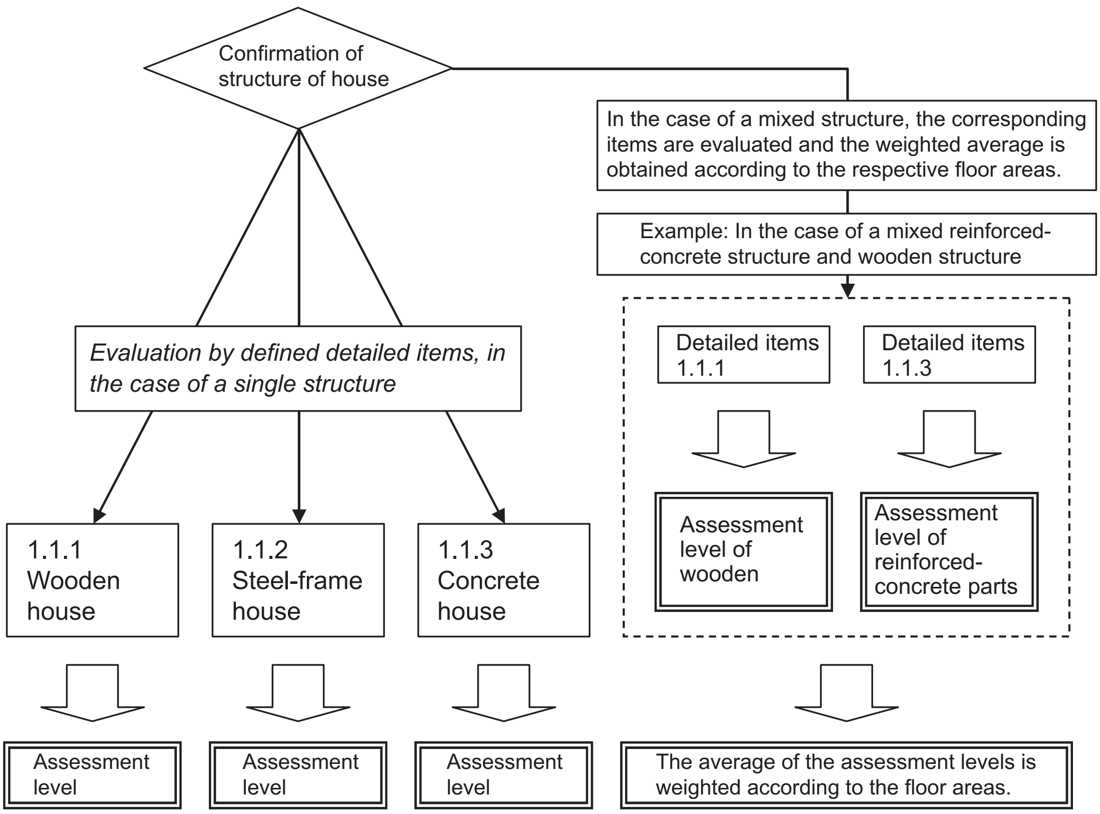


Fig. 2.23: Method of calculating the assessment level in "1.1 Building frames"

■ Explanation of Terminology

Reuse, Recycling:

In defining "reuse" and "recycling," evaluations in terms of the 3Rs (Reduce, Reuse, and Recycle) are clarified.

In this assessment, the aspect of "Reduce" is evaluated based on the reduction of virgin resource input by the introduction of materials that are useful for resource saving (recycled materials, renewable materials). Also evaluated are the introduction of materials that are useful for waste prevention (recyclable materials) and/or efforts related to "Reuse" as a contribution to the objective of "Reduce."

In the criteria, "Reuse" and "Recycle" are defined as below in accordance with the Fundamental Law for Establishing a Sound Material-Cycle Society.

- The term "Reuse" refers to "Reuse" in the Law, and to the actions listed below.
  - ○ Use of recyclable resources (those useful among waste items) as products in their present condition (including their use after repair).
  - ○ Use of the whole or part of recyclable resources (those useful among waste items) as components or parts of products.
- The term "Recycle" refers to the act of "Regeneration" in the Law, and means use of the whole or part of recyclable resources (those useful among waste items) as raw materials.

Recycled materials:

In this assessment, recycled materials are defined as below.

- Materials that are recycled or components and/or parts using these materials (quantitative evaluation of recycling is not taken into consideration).
- Materials designated by the Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (referred to as the "Law on Promoting Green Purchasing").

Renewable materials:

In this assessment, renewable materials mean materials that can be used without fear of resource depletion and that fall under either of the following categories. In general, natural materials include a broad range of materials other than industrial goods, but from the perspective of resource conservation, those derived from mineral resources (stone materials, etc.) are not evaluated.

- Wood produced from sustainable forests.
- Plant-derived natural resources (bamboo, kenaf, etc.) that require a short period to become available.

Wood produced from sustainable forests:

The scope of wood from sustainable forests is described below. (Formwork is not evaluated.)

1. Thinned wood.
2. Wood produced from a forest under sustainable forestry management (for which the method of verification complies with the "Guidelines for Verification of Legality and Sustainability of Wood and Wood Products" (Forestry Agency of Japan, 2006, described later)).
3. Conifer wood produced in Japan.

In Japan, a system to verify that forests where sustainable forestry is conducted are the place of origin of wood, as in other countries, is still at the stage of being disseminated, and there is only a small volume of wood with such an indication; for example, by stamping. In reality, thinned wood and conifer timber such as cedar wood considered to be produced from sustainable forests are treated as wood produced from sustainable forests. Among the coniferous trees listed in "Building Code Notification No. 1452 of 2000" (determining criteria for wood strength), wood from those produced in Japan can be considered to be cut from sustainable forests.

In addition, wood-based materials such as laminated wood and plywood, which conform with these definitions, can be considered to be produced from sustainable forests.

Examples of conifers produced in Japan:

Japanese red pine, larch, hiba (*Hiba arborvitae*), Japanese cypress, Japanese spruce, Sakhalin fir, Japanese cedar.

*This definition is from the revision to "CASBEE for New Construction" (2006 Edition).

Recyclable materials:

In this assessment, recyclable materials refer to aluminum, iron, and copper, which are relatively easy to recycle.

(Reference 1) Forest Certification Systems

In these systems, third-party organizations assess and certify the level of forest management based on criteria defined by independent forest certification organizations. The Forest Stewardship Council (FSC) and Programme for the Endorsement of Forest Certification Schemes (PEFC) are representative forest certification systems, and various other systems are also widely adopted. Some of the representative systems including FSC and PEFC are listed below.

Forest Stewardship Council (FSC) (http://www.fsc.org/)

FSC was established in 1993. The FSC headquarters (FSC International) has been established as a nongovernmental, nonprofit organization in Bonn, Germany, and subordinate organizations are growing in many countries and regions around the world. Each country or region has its own FSC forest certification standards, and sets respective standards that meet the needs of each country or region based on 10 principles set forth by the FSC headquarters and 56 standards based on them.

In addition to forest certification, other efforts being made are the establishment of processing route traceability for forestry products and implementation of certification of production, processing, and distribution management (chain of custody: CoC) to guarantee the compliance of completed forestry products with FSC and other standards stipulated by FSC.

Sustainable Forestry Initiative (SFI) (http://www.sfiprogram.org/)

Founded in 1994 by the American Forest & Paper Association (AF&PA), a forest product industry group with the largest corporate membership among forest industry associations in the United States, SFI is the most popular forest certification system in North America and provides a cross-certification arrangement with PEFC and ATFS. The system has been operated by an independent organization, Sustainable Forestry Initiative, Inc., since January 2007. The SFI standards are composed of 13 sections including sustainable forestry, wood procurement policies, disclosure of reports, continuous improvement, and control of illegal felling.

American Tree Farm System (ATFS) (http://www.treefarmsystem.org/)

ATFS is the oldest forest certification system in the United States, established in 1941. It is operated by the American Forest Foundation, a nonprofit organization that has its headquarters in Washington D.C. It mainly deals with owners of small-scale forests, and among all of the forest certification systems it has the largest number of members. It also adopts third-party certification, and implements a cross-certification system with SFI.

Programme for the Endorsement of Forest Certification Schemes (PEFC) (http://www.pefc.org/internet/html/)

PEFC was established in 1999. It is an NGO operated with the aim of mutually approving independent sustainable forest certification standard systems of individual countries. It has its headquarters in Luxembourg, and forest certification standard systems from 31 countries (including SFI and ATFS) have joined PEFC so far. The forest certification standard systems of each country adopt international forest management standards for sustainable forest management, referred to as the intergovernmental process, and they are planned and operated autonomously by stakeholders of forestry unions, owners and managers of forests, timber producers, wood product distributors, pulp and paper manufacturers and distributors, environmental groups, and various related bodies. PEFC carries out CoC certification, which is certified by third-party organizations.

PEFC/01-00-01
Promoting Sustainable Forest Management
For more info: www.pefcasia.org
PEFC logo used under license from the PEFC Council.

Sustainable Green Ecosystem Council (SGEC) (http://www.sgec-eco.org/)

Founded in 2003, SGEC promotes a set of international standards. It was created based on globally recommended ideas concerning sustainable forest management and actual conditions of Japanese forests, in which the proportion of artificial forests is larger and the ownership scale is small. Inspections are conducted after setting up "inspection requirements" (specific inspection items), which comply with the conditions of "certification credits" among SGEC's seven standards and 36 indicators based on the Montreal Process (International Standards), in which Japan participates. SGEC also certifies business entities handling SGEC-certified forestry products as a separation and labeling system (that is, CoC certification) in addition to forest certification.

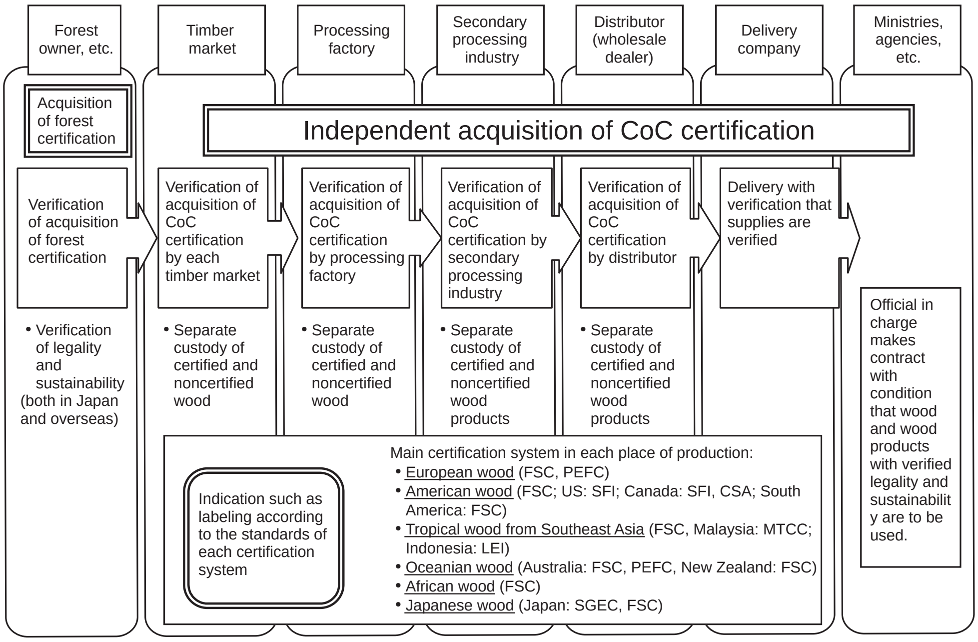
(Reference 2) Wood and Wood Products Procured by the Japanese Government

Under the "Basic Policy for the Promotion of Procurement of Eco-Friendly Goods and Services" agreed on by the Cabinet on February 28, 2006, the government has decided to promote procurement based on the "Guidelines for Verification of Legality and Sustainability of Wood and Wood Products" announced by the Forestry Agency. This is in line with the decision made at the Gleneagles Summit held in the United Kingdom in July 2005 to take specific measures such as government procurement, trade restrictions, and support for timber-producing countries.

The following is an outline of the methods of verifying legality and sustainability in the Agency's guidelines:

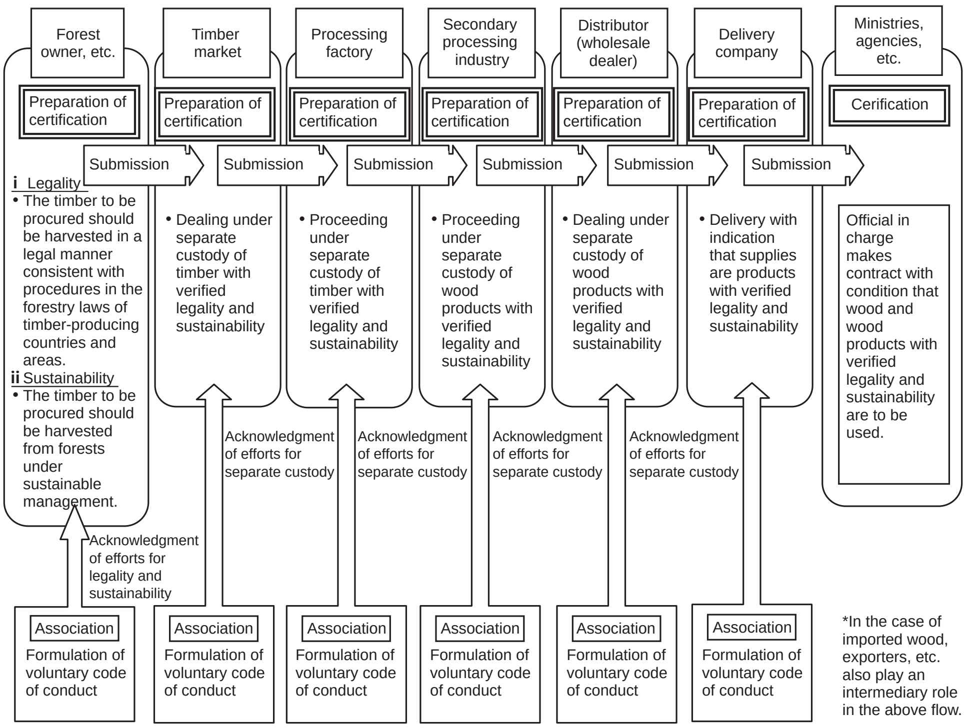
① Method using forest certification system and chain of custody certification system

A method to verify that wood and wood products have been produced in certified forests by sealing a certification mark on them in conjunction with CoC certification. (A conceptual figure is shown below.)



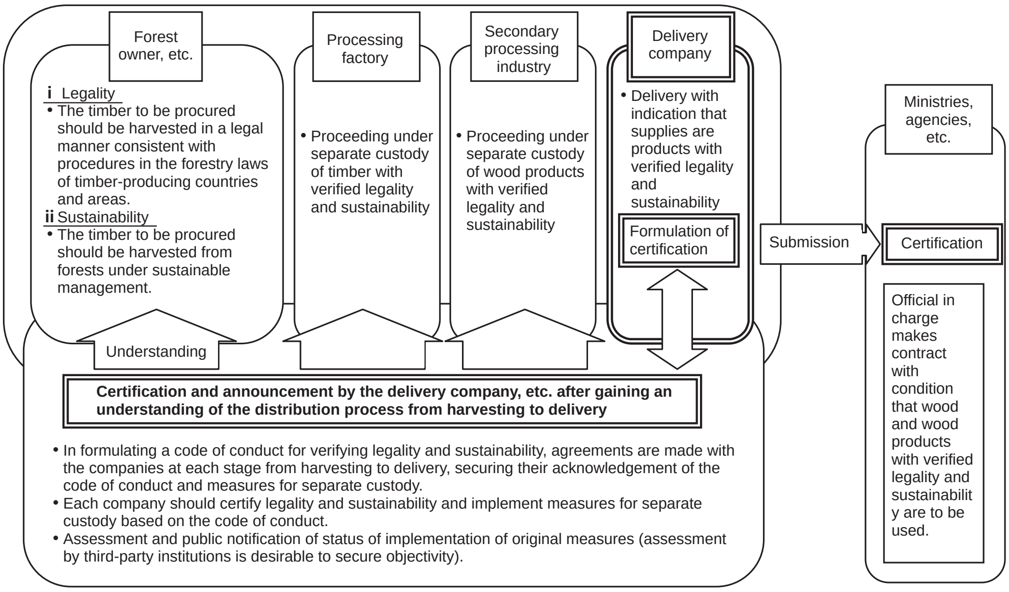
② Method using voluntary codes of conduct of industry groups

A method of verification in which each business issues certificates after its industry group has established its own voluntary code of conduct. (A conceptual figure is shown below.)



③ Method using individual operators' own efforts

A method of verification in which individual companies formulate their own measures. (A conceptual figure is shown below).



*In the case of imported wood, exporters, etc. also play an intermediary role in the above flow.

(Reference 3) "Green Purchasing Laminated Wood Products"

Based on the Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Law on Promoting Green Purchasing) and according to the "Basic Policy for the Promotion of Procurement of Eco-Friendly Goods and Services" (Part III 2.2 (Reference 4) as decided by the Cabinet in March 2004, sawn timber, in which thinned wood is used as part of the raw materials, laminated wood products, and recycled wooden boards have been designated as specified procurement items, which are preferentially purchased by the government. "Green purchasing laminated wood products" is the term used by the Japan Laminated Wood Products Association.

1.1.1 Wooden house

■ Assessment Item

Evaluate the extent to which wooden materials produced from sustainable forests are used for the building frames in the case of a wooden house built by such methods as wood framework construction, two-by-four construction, wood panel construction, or wood unit construction.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	Does not satisfy the criterion of Level 4.
Level 4	Wood produced from sustainable forests is used for more than half of the building frames.
Level 5	Wood produced from sustainable forests is used for the entire building frames.

Availability of conditions for adding points:
*Available
Level change according to conditions:
*None
Assessment not applicable:
*In the case of "1.1.2 Steel-frame house" or "1.1.3 Concrete house"

■ Description

In this section, an evaluation is conducted on the proportion of wood produced from sustainable forests used for the building frames of a wooden house built by such methods as wood framework construction, two-by-four construction, wood panel construction, or wood unit construction.

The term "building frames" here refers to pillars, beams, bracing members, and structural plywood constituting roof trusses and/or bearing walls, but does not include foundations.

"More than half" as specified in Level 4 is judged according to the cubic volume used in the building frames, and cases in which the proportion of wood produced from sustainable forests is lower than 0.5 are evaluated as Level 3.

Conditions for adding points:

The evaluation can be raised by up to two levels when each of the following conditions are met. However, if the resultant level exceeds Level 5, it is evaluated as Level 5.

Part 1

The level is raised by 1 in a case where wood whose legality and sustainability are verified according to "① Method using forest certification system and chain of custody certification system," "② Method using voluntary codes of conduct of industry groups," or "③ Method using individual operators' own efforts" in the "Guidelines for Verification of Legality and Sustainability of Wood and Wood Products" (Forestry Agency, refer to previous related information) is used for more than half of the building frames. In general, wood whose legality and sustainability is verified by method ① is the norm from the viewpoint of independence, but verification by methods ② and ③ may also be permitted considering the current distribution status and the importance of promoting the use of wood and wood products with verified legality.

Part 2

The level is raised by 1 or 2, respectively, when reused materials once used in other building structures are used for part of or more than half of the building frames.

■ Explanation of Terminology

Wood produced from sustainable forests:

See "LR_H2.1.1 Building frames" for the definition of this term.

1.1.2 Steel-frame house

■ Assessment Item

Evaluate the extent to which electric steel is used in the building frames in the case of a steel-frame house of light-gauge or heavy-gauge steel structure, or built by the steel unit construction method.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	Electric steel is not used in the building frames or it cannot be confirmed.
Level 4	Electric steel is used for part of the building frames.
Level 5	Electric steel is used for more than half of the building frames.

Availability of conditions for adding points:
*Available
Level change according to conditions:
*None
Assessment not applicable:
*In the case of "1.1.1 Wooden house" or "1.1.3 Concrete house"

■ Description

This evaluation is conducted according to the proportion of electric steel that is used in the building frames of a steel-frame house of light-gauge or heavy-gauge steel frames, or built by the steel unit construction method. Although iron scrap can be considered as a recycled material because it is included when virgin steel is manufactured, it is not evaluated in this assessment because the percentage is low, at 2-3%.

The term "building frames" here refers to pillars, beams, roof trusses, and sill plates manufactured using steel materials, but does not include plywood used in the floor, roof sheathing board, and exterior wall sheathing, nor foundations.

As electric steel and virgin steel are produced by different manufacturers, the steel grade can be judged accordingly.

Regarding Levels 4 and 5, the judgment is made according to the proportion (weight) of electric steel used in the building frames. A case in which the proportion is lower than 0.5 is evaluated as Level 4, while case in which the proportion is 0.5 or higher is evaluated as Level 5.

Conditions for adding points:

When reused materials once used in other building structures are used for part of or more than half of the building frames, the level is raised by 1 or 2, respectively. However, if the resultant level exceeds Level 5, it is evaluated as Level 5.

■ Explanation of Terminology

Electric steel:

Steel produced by an electric furnace from recovered iron scrap melted by the furnace.

1.1.3 Concrete house

■ Assessment Item

Evaluate efforts to save resources in the case of a concrete house with a reinforced-concrete structure or reinforced-concrete box frame structure.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	Neither of Efforts to be evaluated No. 1 or 2 have been implemented.
Level 4	Either one of Efforts to be evaluated No. 1 or 2 has been implemented.
Level 5	Both of Efforts to be evaluated No. 1 and 2 have been implemented.

Efforts to be evaluated

No.	Effort
1	Blended cement (blast-furnace cement or fly-ash cement) or eco-cement is used for the structural concrete. (Use in blinding concrete or exterior wainscots is not evaluated.)
2	Recycled aggregate or slag aggregate for concrete is used for the structural concrete. (Use in blinding concrete or exterior wainscots is not evaluated.)

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*In the case of "1.1.1 Wooden house" or "1.1.2 Steel-frame house"

■ Description

In this section, efforts to save resources in the case of a concrete house with a reinforced-concrete structure or reinforced-concrete box frame structure are evaluated.

The term "building frames" referred to here does not include blinding concrete, exterior wainscots, and foundations. However, because concrete using recycled aggregate does not conform with JIS, attention should be paid to the requirement of attestation based on Article 37 of the Building Standards Act in order to use it in foundations and principal structural parts.

Here, quantitative evaluation is not conducted concerning the efforts made.

Blended cement (blast-furnace cement or fly-ash cement), eco-cement, and slag aggregate used for concrete are materials designated by the Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Law on Promoting Green Purchasing).

■ Explanation of Terminology

Blended cement:

Blended cement is cement mainly composed of Portland cement, mixed with silica admixture, blast-furnace slag fines and fly ash.

Blast-furnace cement:

Blast furnace cement is blended cement in which rapidly cooled blast-furnace slag fines are used as an additive. There are three types, A, B, and C, according to the amount of additive.

Fly-ash cement:

Fly-ash cement is blended cement in which fly ash, a byproduct from the firing of pulverized coal, is used as an additive.

Eco-cement:

Eco-cement is cement produced using waste such as the residue of incinerated urban garbage (incineration ash, soot, and dust) as the main raw material.

Recycled aggregate:

Recycled aggregate is aggregate that is reused in concrete, obtained by pulverizing and separating concrete and concrete products generated as waste from demolished buildings and structures.

Slag aggregate used for concrete:

Slag aggregate is aggregate used for concrete that is produced as a byproduct of the iron and steel manufacturing process.

1.2 Ground-reinforcing materials, foundation work, and foundations

■ Assessment Item

Evaluate efforts to save resources with respect to ground-reinforcing materials, foundation work, and foundations.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	None of Efforts to be evaluated No. 1 through 3 have been implemented.
Level 4	One of Efforts to be evaluated No. 1 through 3 has been implemented.
Level 5	Two or more of Efforts to be evaluated No. 1 through 3 have been implemented.

Efforts to be evaluated

No.	Effort
1	Blended cement (blast-furnace cement or fly-ash cement) or eco-cement is used.
2	Recycled aggregate or slag aggregate for concrete is used.
3	Steel slag for foundation improvement is used for improvement of the foundations.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

The efforts evaluated here are basically the same as the detailed items of "LR_H2.1.1.3 Concrete house," but recycled slag and steel slag for foundation improvement designated by the Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Law on Promoting Green Purchasing) are added. However, since concrete using recycled aggregate does not conform with JIS, attention should be paid to the requirement of attestation based on Article 37 of the Building Standards Act in order to use it in foundations and principal structural parts.

Here, quantitative evaluation is not conducted concerning the efforts made.

■ Explanation of Terminology

Recycled aggregate:

Recycled aggregate is aggregate that is reused in concrete, obtained by pulverizing and separating concrete and concrete products generated as waste from demolished buildings and structures.

Steel slag for foundation improvement:

Steel slag that can be used as a substitute for natural sand (sea sand, pit sand).

Refer to "LR_H2.1.1.3 Concrete house" for definitions of blended cement, blast-furnace cement, fly-ash cement, eco-cement, and slag aggregate used for concrete.

1.3 Exterior materials

■ Assessment Item

Evaluate the introduction of materials that are useful for resource saving (recycled and renewable materials) and waste prevention (recyclable materials) in the exterior materials.

■ Assessment Level

Level	Criterion
Level 1	Does not satisfy the criterion of Level 3.
Level 2	(May be selected if the Conditions for adding points are met.)
Level 3	0.4 ≤ Credit ratio [III] in Efforts to be evaluated < 0.6
Level 4	0.6 ≤ Credit ratio [III] in Efforts to be evaluated < 0.8
Level 5	0.8 ≤ Credit ratio [III] in efforts to be evaluated

Efforts to be evaluated

Evaluation points			Effort
Large-scale effort	Small-scale effort	No effort	
2	1	0	Use of material that promotes resource saving or waste reduction for the roofing material (in the case of a sloping roof) or waterproofing material (in the case of a flat roof)
2	1	0	Use of material that promotes resource saving or waste reduction for the roof sheathing material (in the case of a sloping roof) or waterproof sheathing material (in the case of a flat roof)
2	1	0	Use of material that promotes resource saving or waste reduction for the exterior wall material
2	1	0	Use of material that promotes resource saving or waste reduction for the exterior wall sheathing
2	1	0	Use of material that promotes resource saving or waste reduction for the insulation materials
[I] Total points = ____ point(s)			[II] Maximum points = ____ point(s) / [III] Credit ratio ([I]÷[II])= ____

- Cases in which the building frame also functions as an exterior material, such as as-cast concrete walls and construction materials used for uncovered structures in traditional houses, are evaluated.
- Battens for holding tiles used in a tiled roof are evaluated as roofing materials.
- Furring strips and wooden laths as well as surface materials such as plywood are included in exterior wall sheathing.
- In a case where no applicable exterior material is used in a particular category, the effort is not evaluated in that category. In this case, it is not counted in either " [I] Total points" or " [II] Maximum points."
- " [II] Maximum points" is calculated using the following formula:

  Maximum points = Number of efforts subject to evaluation ✕ 2 points (i.e., the effort that can be evaluated as "Large-scale efforts").

  Availability of conditions for adding points:
  *Available

  Level change according to conditions:
  *None

  Assessment not applicable:
  *None

■ Description

In this section, the term "exterior material" means only the main materials constituting the exterior of the building and does not include ancillary items such as louvers and lattices, nor underthroating. The exterior materials evaluated are roofing materials, waterproofing materials, roof sheathing materials, waterproof sheathing materials, exterior wall materials, exterior wall sheathing, and insulation materials.

Evaluation is carried out according to the credit ratio, after assessing the introduction of materials that are useful for resource saving (recycled materials, renewable materials) and materials useful for waste prevention (recyclable materials) in the exterior materials.

With regard to the extent of efforts concerning materials other than insulation materials, the use of such materials for surface materials is treated as a "Large-scale effort," while the use of such materials for linear elements such as scantlings and joiners is treated as a "Small-scale effort." The use of small items such as metal fittings, screws, and nails is not treated as an effort.

With regard to the extent of efforts concerning insulation materials, overall use of recycled materials is regarded as a "Large-scale effort" and partial use as a "Small-scale effort."

Conditions for adding points:

When reused materials once used in other building structures are used for part of or more than half of the exterior materials, the level is raised by 1 or 2, respectively. However, if the resultant level exceeds Level 5, it is evaluated as Level 5.

■ Explanation of Terminology

Refer to "LR_H2.1.1 Building frames" for the definitions of reused materials, recycled materials, renewable materials, and recyclable materials.

(Reference 1) Examples of Materials Useful for Resource Saving (Recycled Materials)

Name of product	Main applications	Raw materials used
Tiles (recycled materials)	Exterior walls	Ash from incineration of sewage sludge, liquid slag, waste glass, waste ceramics, etc.
Resin construction materials mixed with wood flour (construction materials made from wood flour and thermoplastic resin by mixing and molding)	Battens for holding tiles, eave boards	Waste plastic, wood flour
Recycled plastic	Exterior wall sheathing	Waste plastic
Recycled insulation material (including cellulose fiber)	Insulation material	Waste wood material, PET bottles, used paper
Rock wool	Insulation material	Blast-furnace slag
Glass wool	Insulation material	Recycled glass
Recycled wooden board (particleboard)	Sheathing material	Waste wood material
Recycled wooden board (fiberboard)	Sheathing material	Waste wood material
Ceramic siding material	Surface material for exterior walls	Used paper pulp, blast-furnace slag
Exterior materials other than those listed above made using waste or byproducts from other industries.		

(Reference 2) Definition of Materials Useful for Resource Saving (Renewable Materials)

The term "renewable materials" refers to wood produced from sustainable forests or to plant-derived natural materials that require a short period to become available (e.g., grass or straw for thatched roofs, etc.). Refer to "LR_H2.1.1 Building frames" for details.

(Reference 3) Examples of Materials Useful for Waste Prevention (Recyclable Materials)

Aluminum, iron, copper

(Reference 4) Problem regarding Distribution of Materials Subject to Evaluation

In cases where it is difficult to obtain the materials that are subject to this evaluation (reused, recycled, reusable, or recyclable materials), major manufacturers can produce such materials by themselves (such as meter-module-based plywood from domestic coniferous trees), but ordinary builders cannot. This may place the latter builders at a disadvantage when it comes to evaluation. It is essential to prevent the size of a corporation from affecting judgments made for evaluations, but at present it is difficult to find an effective solution. Thus, it is necessary for this matter to be on the agenda for future solution.

1.4 Interior materials

■ Assessment Item

Evaluate the introduction of materials that are useful for resource saving (recycled and renewable materials, plant-derived natural materials) and waste prevention (recyclable materials) in the interior materials.

■ Assessment Level

Level	Criterion
Level 1	Does not satisfy the criterion of Level 3.
Level 2	(May be selected if the Conditions for adding points are met.)
Level 3	0.4 ≤ Credit ratio [Ⅲ] in Efforts to be evaluated < 0.6
Level 4	0.6 ≤ Credit ratio [Ⅲ] in Efforts to be evaluated < 0.8
Level 5	0.8 ≤ Credit ratio [Ⅲ] in efforts to be evaluated

Efforts to be evaluated

Evaluation points			Effort	
Large-scale effort	Small-scale effort	No effort		
2	1	0	Use of material that promotes resource saving or waste reduction for the floor finishing material	
2	1	0	Use of material that promotes resource saving or waste reduction for the subfloor material	
2	1	0	Use of material that promotes resource saving or waste reduction for the interior wall finish	
2	1	0	Use of material that promotes resource saving or waste reduction for the interior wall sheathing material	
2	1	0	Use of material that promotes resource saving or waste reduction for the ceiling finish	
2	1	0	Use of material that promotes resource saving or waste reduction for the ceiling sheathing material	
[Ⅰ] Total points = ____ point(s)			[Ⅱ] Maximum points = ____ point(s)	[Ⅲ] Credit ratio ([Ⅰ]÷[Ⅱ])= ____

- Cases in which the building frame also functions as an interior material, such as as-cast concrete walls and construction materials used for uncovered structures in traditional houses, are evaluated.
- In a case where no applicable interior material is used in a particular category, the effort is not evaluated in that category. In this case, it is not counted in either " [Ⅰ] Total points" or " [Ⅱ] Maximum points."
- " [Ⅱ] Maximum points" is calculated using the following formula:

  Maximum points = Number of efforts subject to evaluation ✕ 2 points (i.e., the effort that can be evaluated as "Large-scale efforts").

  Availability of conditions for adding points:

  *Available

  Level change according to conditions:

  *None

  Assessment not applicable:

  *None

■ Description

The interior materials evaluated are the finishing materials and sheathing materials used for floors, interior walls and ceilings. Insulation materials are not evaluated as they are evaluated in "LR$_H$2.1.3 Exterior materials."

Evaluation is carried out according to the credit ratio, after assessing the introduction of materials that are useful for resource saving (recycled materials, renewable materials) and materials useful for waste prevention (recyclable materials) as interior materials.

With regard to the extent of efforts, the use of such materials for surface materials in a living room is treated as a "Large-scale effort," while the use of such materials for linear elements such as skirtings or baseboards, crown moldings, and scantlings is treated as a "Small-scale effort." The use of small items such as metal fittings, screws, and nails is not treated as an effort.

Conditions for adding points:

When reused materials once used in other building structures are used for part of or more than half of the interior work, the level is raised by 1 or 2, respectively. However, if the resultant level exceeds Level 5, it is evaluated as Level 5.

■ Explanation of Terminology

Refer to "LR_H2.1.1 Building frames" for the definitions of reused materials, recycled materials, renewable materials, and recyclable materials.

(Reference 1) Examples of Materials Useful for Resource Saving (Recycled Materials)

Name of product	Main applications	Raw materials used
Tiles (recycled materials)	Interior walls	Ash from incineration of sewage sludge, liquid slag, waste glass, waste ceramics, etc.
Resin construction materials mixed with wood flour (construction materials made from wood flour and thermoplastic resin by mixing and molding)	Interior walls (wainscots)	Waste plastic, wood flour
Recycled wooden board (particleboard)	Sheathing material	Waste wood material
Recycled wooden board (fiberboard)	Sheathing material	Waste wood material
Plasterboard	Sheathing material	Desulfurized plaster
Interior materials other than those listed above made using waste or byproducts from other industries.		

(Reference 2) Definition of Materials Useful for Resource Saving (Renewable Materials)

The term "renewable materials" refers to wood produced from sustainable forests or plant-derived natural materials that require a short period to become available (bamboo flooring, kenaf wallpaper, tatami matting, bamboo laths, etc.). Refer to "LR_H2.1.1 Building frames" for details.

(Reference 3) Examples of Materials Useful for Waste Prevention (Recyclable Materials)

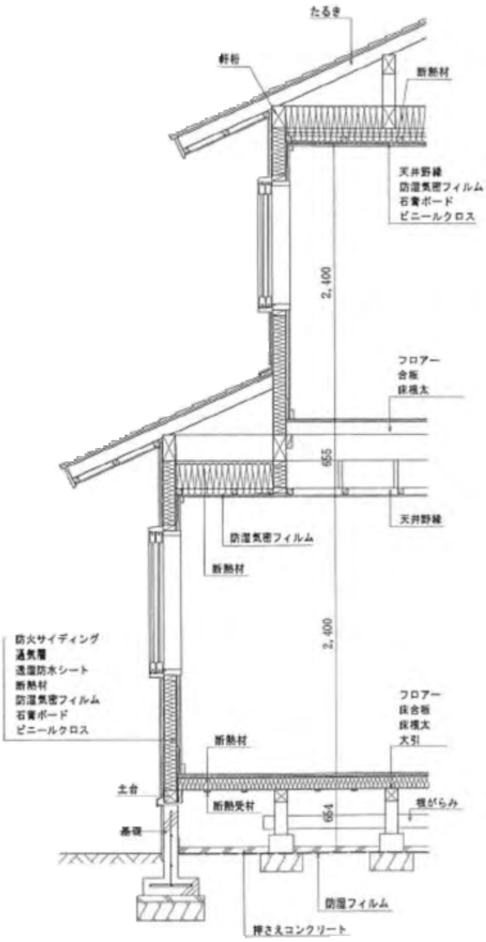
Aluminum, iron, copper

(Reference 4) Problem regarding Distribution of Materials Subject to Evaluation

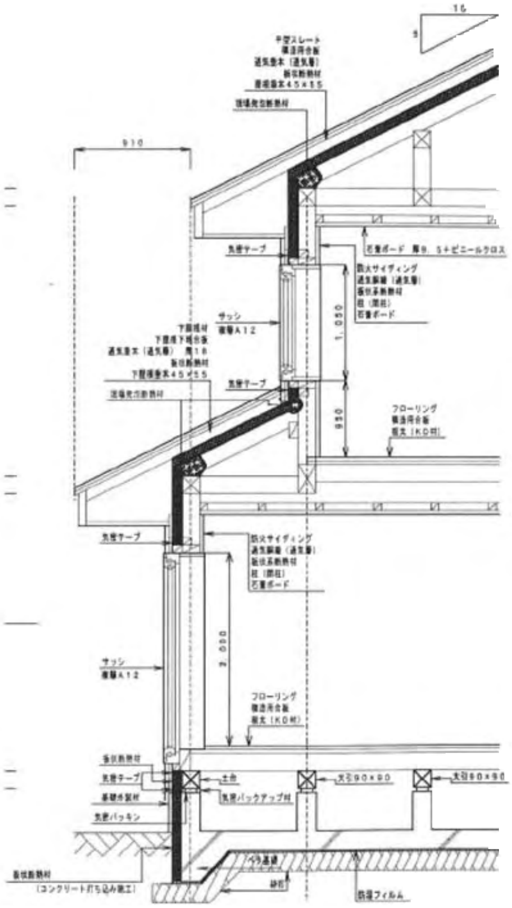
In cases where it is difficult to obtain the materials that are subject to this evaluation (reused, recycled, reusable, or recyclable materials), major manufacturers can produce such materials by themselves (such as meter-module-based plywood from domestic coniferous trees), but ordinary builders cannot. This may place the latter builders at a disadvantage when it comes to evaluation. It is essential to prevent the size of a corporation from affecting judgments made for evaluations, but at present it is difficult to find an effective solution. Thus, it is necessary for this matter to be on the agenda for future solution.

(Examples of Evaluation)

Infilled insulation method for conventional wood framework construction (Case 1)

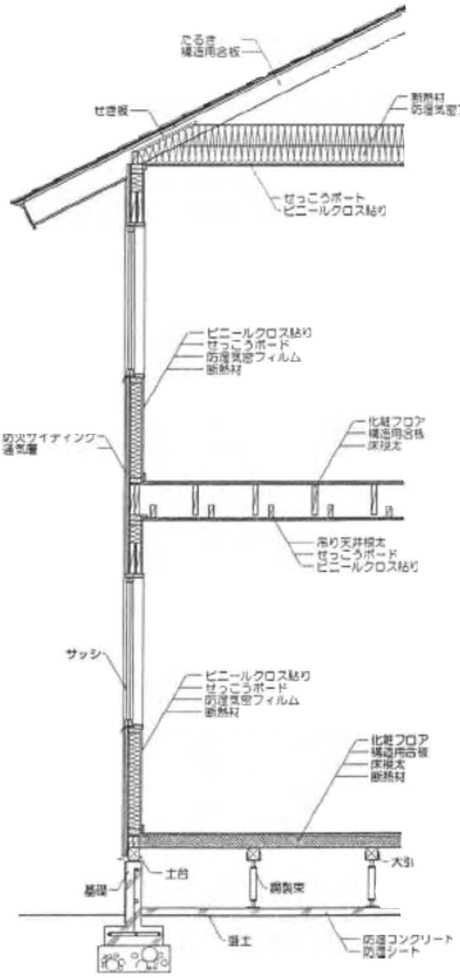


Externally fitted insulation method for conventional wood framework construction (Case 2)



		Case 1	Case 2
Floor finishing material		Flooring (plywood base material)	Flooring (plywood base material)
		0	0
Subfloor material		Structural plywood	Structural plywood
		0	0
Interior wall finish		Vinyl wallpaper	Japanese *washi*-style wallpaper
		0	2
Interior wall sheathing material		Plasterboard	Plasterboard
		2	2
Ceiling finish		Vinyl wallpaper	Japanese *washi*-style wallpaper
		0	2
Ceiling sheathing material		Plasterboard	Plasterboard
		2	2
Assessment	Total score	4 (4/12 = 0.33)	8 (8/12 = 0.67)
	Level	Level 1	Level 4

Infilled insulation method for two-by-four construction
(Case 3)



		Case 3
Floor finishing material		Flooring (plywood base material)
		0
Subfloor material		Structural plywood (sustainability-verified material)
		2
Interior wall finish		Vinyl wallpaper
		0
Interior wall sheathing material		Plasterboard
		2
Ceiling finish		Vinyl wallpaper
		0
Ceiling sheathing material		Plasterboard
		2
Assessment	Total score	6 (6/12 = 0.5)
	Level	Level 3

1.5 Materials for the external area

■ Assessment Item

Evaluate the introduction of materials for the external area that are useful for resource saving (recycled and renewable materials).

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	None of Efforts to be evaluated No. 1 through 4 have been implemented.
Level 4	(No corresponding level)
Level 5	Any of Efforts to be evaluated No. 1 through 4 have been implemented.

Efforts to be evaluated

No.	Effort	
1	Use of recycled materials	• Application of paving blocks made from waste clay from the ceramic industry or waste glass to corridors or parking lots • Installation of an outdoor deck made of artificial materials produced from wood powder and thermoplastic resin • Use of materials for the external area that are made of waste and byproducts from other industries
2	Use of reused materials	• Use of recycled stone for pavement stone • Use of used bricks for flower beds
3	Use of wood products produced from sustainable forests	• Installation of an outdoor deck made of wood produced from sustainable forests • Application of wood produced from sustainable forests to the external area
4	Use of natural materials made from plants that quickly become usable as materials and are less likely to be depleted in terms of resources	• Use of bamboo products • Application of natural materials made from plants that quickly become usable as materials and are less likely to be depleted in terms of resources to the external area

In the above table of "Efforts to be evaluated," wood produced from sustainable forests and plant-derived natural materials are evaluated. The evaluations are made only for the raw materials, not for their use in terms of planting.

Availability of conditions for adding points:

*None

Level change according to conditions:

*None

Assessment not applicable:

*None

■ Description

In this section, materials that are useful for resource saving, recycled materials, and renewable materials (wood produced from sustainable forests, and plant-derived natural materials that can be used without fear of resource depletion and that require a short period to become available) are evaluated.

Although metal materials are evaluated as recyclable materials when used for exterior and interior materials, they are excluded from evaluation in the case of the external area because aluminum is already in widespread use in external areas.

■ Explanation of Terminology

Refer to "LR$_H$2.1.1 Building frames" for the definitions of recycled materials, renewable materials, and wood produced from sustainable forests.

2 Reduction of Waste in the Production and Construction Stages

2.1 Production stage (members for building frames)

■ Assessment Item

Evaluate efforts to reduce waste at the production and processing stages of members for the building frames.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	No instructions have been given on efforts to reduce the generation of byproducts in the structural member production and processing stages or to promote recycling, and no such efforts have been implemented.
Level 4	(No corresponding level)
Level 5	Instructions have been given by means of design documents, etc. on efforts to reduce the generation of byproducts in the structural member production and processing stages or to promote recycling, or such efforts have actually been implemented.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*A case in which members for the building frames are not processed in a factory but only at the construction site is not evaluated.

■ Description

In this section, among efforts to reduce waste at the production and processing stages, efforts related to the building frame members are evaluated.

Basically, the evaluation is targeted at efforts with respect to the corresponding type of construction work, but efforts to reduce waste by the companies concerned are also evaluated. The efforts of precutting factories in the case of wooden construction, steel frame production factories in the case of steel construction, or reinforcing-steel processing factories or production factories of prefabricated structure manufacturers in the case of reinforced-concrete construction are assessed, and cases in which ISO 14001 certification has been acquired, or zero emissions have been achieved, are evaluated as Level 5. Examples of efforts made are shown below.

Examples of Byproduct Reduction
- Reduction of materials during processing on the basis of each type of construction
- Economical cutting from standard-sized materials
- Delivery of materials by suppliers using simple packaging and returnable containers

Examples of Promotion of Byproduct Recycling
- Thorough separation of byproducts
- Recycling of wood offcuts into particleboard, material recycling such as manufacturing of artificial wood by wood flour and use of polypropylene (PP) bands
- Energy recovery through a cogeneration system using wood offcuts, etc.

2.2 Production stage (members other than those for building frames)

■ Assessment Item

Evaluate efforts to reduce waste at the production and processing stages of members other than those for the building frames.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	Does not satisfy the criterion of Level 4.
Level 4	Instructions have been given by means of design documents, etc. on the use of one or two materials, other than members for the building frames, for which efforts have been made to reduce the generation of byproducts during the production or processing stages or to promote recycling, or such efforts have actually been implemented.
Level 5	Instructions have been given by means of design documents, etc. on the use of three or more materials, other than members for the building frames, for which efforts have been made to reduce the generation of byproducts during the production or processing stages or to promote recycling, or such efforts have actually been implemented.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

In this section, efforts to reduce waste at the production and processing stages of members other than those for the building frames are evaluated.

Materials for which efforts are made to reduce the generation of byproducts or promote recycling at the production and processing stages refer to the following two types of materials:

- Construction materials obtained from a factory that has acquired ISO 14001 certification.
- Construction materials of a manufacturer designated under the "wide-area recycling designation system."

In addition, cases such as the factories of prefabricated structure manufacturers that produce members for building frames and other members are evaluated, and cases in which ISO 14001 certification has been acquired, or zero emissions have been achieved, are evaluated as Level 5.

■ Explanation of Terminology

Wide-area recycling designation system:

This is a system created in the form of a special provision of the Waste Management and Public Cleansing Act in order to promote the smooth collection and recycling by companies of used products that have been manufactured by them. A manufacturer can be specified as a designated industrial waste processor by the Ministry of the Environment by making an application, which will be followed by an examination of the recovery routes, details of the recycled materials, and a summary of consigned contractors for the company's collection and recycling systems. A designated industrial waste processor can collect and recycle its own used products nationwide without the need to obtain permission for industrial waste management (collection, transportation, and disposal).

2.3 Construction stage

■ Assessment Item

Evaluate efforts to reduce waste produced at the construction site.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	No instructions have been given on efforts to reduce the generation of byproducts in the construction stage or to promote recycling, and no such efforts have been implemented.
Level 4	(No corresponding level)
Level 5	Instructions have been given by means of design documents, etc. on efforts to reduce the generation of byproducts in the construction stage or to promote recycling, or such efforts have actually been implemented.

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

In this section, efforts to reduce waste at the construction stage are evaluated.

Basically, the evaluation is targeted at efforts with respect to the actual construction work, but efforts to reduce waste by the companies concerned are also evaluated.

Examples of efforts made to reduce waste at the construction stage are shown below.

Examples of Reduction of Waste

- Reduction of onsite processing by using precut materials, etc.
- Reduction of formwork materials by using metal forms
- Thorough separation of byproducts
- Collection of byproducts

In addition, cases in which ISO 14001 certification has been acquired, or zero emissions have been achieved, are evaluated as Level 5.

3 Promotion of Recycling

3.1 Provision of information on materials used

■ Assessment Item

Evaluate the provision of information on disposal and recycling of materials used in the house.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	No information on recycling or disposal of materials used in the building has been given to the occupants.
Level 4	(No corresponding level)
Level 5	Some information on recycling or disposal of materials used in the building has been given to the occupants.

Availability of conditions for adding points:

*None

Level change according to conditions:

*In a case where it is difficult to implement the effort listed above, the provision of information that makes it possible to identify the manufacturers, names of products, and model numbers of materials used as surface materials and linear elements in the framework, interior, and exterior materials is evaluated, and if such information is provided, it is evaluated as Level 5. In this case, the provision of information is not required for metal connectors (screws and nails), adhesives, double-sided tapes, sealing materials, subsidiary materials such as coating materials, and natural materials such as wood, stones, and soil.

Assessment not applicable:

*None

■ Description

In this section, the provision of information on the disposal and recycling of materials used in the house is evaluated.

Specifically, the provision of information to the occupants on recycling of materials, precautions in the case of demolition work, and procedures in the case of disposal is evaluated.

However, it is very difficult to predict future circumstances such as the development of recycling technologies and occurrence of new environmental pollution problems, and only the information available at the time of construction can be provided, but as it is highly important to identify the materials used in a house at the time of its demolition, this aspect is included in the evaluation. In this case, it is desirable for the composition of the materials to be provided, but as it is realistic to provide information for the identification of materials, information that enables to identify manufacturers, name of products, model numbers of the materials used as surface materials and linear elements in the framework, interior, and exterior materials is evaluated. Information on metal connectors (screws and nails), adhesives, double-sided tapes, sealing materials, and subsidiary materials such as coating materials is not included in the evaluation items, as they are often procured at the construction site.

Regarding the means by which the information is provided, the media evaluated are not limited to paper media such as drawings, but also include magnetic storage media and the Internet.

The evaluation is targeted not only at efforts with respect to the actual construction work, but also those by the companies concerned. However, the provision of information on materials not used in the actual house (for example, asbestos) is not evaluated.

The provision of information on materials used in houses is currently at the development stage and is still uncommon. It is hoped that this practice will be further promoted.

1 Consideration of Global Warming

■ Assessment Item

Evaluate the level of consideration of global warming in terms of the carbon dioxide emissions produced from all processes of the house from construction to occupancy, renovation, demolition, and disposal (referred to herein as "life cycle CO_2").

■ Assessment Level

Level	Criterion
Level 1 to Level 5	Levels are expressed in life cycle CO_2 emission rates converted to any of the numbers 1 through 5 (down to the first decimal place). Levels 1, 3, and 5 are defined by the following emission rates: Level 1: The life cycle CO_2 emission rate is 125% or higher than that of an ordinary house (reference value). Level 3: The life cycle CO_2 emission rate is equal to that of an ordinary house (reference value). Level 5: The life cycle CO_2 emission rate is 75% or lower than that of an ordinary house (reference value).

Availability of conditions for adding points:
*None
Level change according to conditions:
*None
Assessment not applicable:
*None

■ Description

Fossil fuels are consumed in various stages of a house's life cycle from construction to occupancy, renovation, demolition, and disposal, and large amounts of carbon dioxide are emitted as these fuels are consumed. To be more specific, during the construction stage materials are gathered and formed into building blocks and members, which are transported to the construction site, and the house is built. During occupancy, the residents of the house consume electricity, gas, and water, and replace building members and facilities. CO_2 emitted in connection with all of these activities related to housing is said to account for one-sixth of the total CO_2 emissions in Japan. Measures to prevent global warming related to housing are therefore a major issue.

CO_2 emitted in the life cycle processes of the house being evaluated, ranging from construction to demolition and disposal, (life cycle CO_2) is compared with that of an ordinary house to evaluate the reduction effect of the targeted house. Calculation of life cycle CO_2 requires a large amount of time and specialized knowledge, and it is difficult to perform during the execution stage of housing construction. Therefore, the assessment results obtained for other evaluation items (17 items selected from Q$_H$2 and LR$_H$1), which have a large impact on life cycle CO_2, are used to simplify the calculation process. The specific calculation procedure is shown in detail in Part III.

Scoring items used in life cycle CO_2 calculation			Utilization in calculation
Q$_H$2 Ensuring a Long Service Life	1. Basic Life Performance	1.1 Building frames	Used in calculation of CO_2 emissions from "construction" and "renovation, repair, and demolition"
		1.2 Exterior wall materials	
		1.3 Roof materials/flat roof	
	2. Maintenance	2.2.2 Maintenance system	
LR$_H$1 Conserving Energy and Water	1. Energy Saving through Building Innovation	1.1 Control of thermal load of building	Used in calculation of CO_2 emissions from "occupancy"
		1.2 Natural energy use	
	2. Energy Saving through Equipment Performance	2.1.1 Heating system	
		2.1.2 Cooling system	
		2.2.1 Hot-water supply equipment	
		2.2.2 Heat insulation of bathtub	
		2.2.3 Hot-water plumbing	
		2.3 Lighting fixtures, home	

		electric appliances, and kitchen equipment	
		2.4 Ventilation system	
		2.5.1 Home cogeneration system	
		2.5.2 Solar power generation system	
	3. Water Conservation	3.1 Water-saving systems	
		3.2 Rainwater use	

In addition to these, there are various efforts that help to reduce CO_2 emissions. Of them, some efforts that are more effective and for which it is easier to set general evaluation conditions have been selected for evaluation.

Although there is currently no definitive evaluation approach for "LR_H1.2.5.1 Home cogeneration system," a tentative evaluation approach has been established for gas engine cogeneration systems, which have already become widely disseminated today. Specifically, the recovered waste heat from power generation using this system is taken into consideration, and hot-water supply and heating with a gas-engine cogeneration system are evaluated as Level 5. Based on this level setting, CO_2 emissions are calculated with respect to this system.

The above calculation is automatically conducted by the dedicated software, and the results are shown in "Life Cycle CO_2 (global warming impact chart)" in the "Results" sheet as a comparison with the reference values of an ordinary house.

In addition, these results are converted to a number between Levels 1 and 5 depending on the scale of reduction compared with the reference values, and the converted values are shown in "Assessment of Medium-Level categories (bar charts)" in the "Results" sheet. If the life cycle CO_2 of the evaluated house is equal to the reference value, then its level is 3. If it is 75% or less than 75% of the reference value, its level is 5.

In this evaluation system, the efforts to be evaluated are limited and no efforts other than those specified are assessed. The simplified calculation based on the evaluation results obtained for other items does not necessarily guarantee high precision. However, since even rough amounts of CO_2 emissions from houses or their emission reduction effects are little known to housing suppliers, not to mention general consumers, it is considered important to indicate some values even though they are approximate.

The emission coefficient of electricity used in life cycle CO_2 from the "occupancy" stage can be changed from the default value (0.555 kg-CO_2/kWh) (see Part III, Section 2.5, "Standard Calculation and Calculation according to the Regional Power Company," for details). The dedicated software was developed and designed to show the calculation results based on the changed coefficient on the global warming effect chart of the "Results" sheet. However, the life cycle CO_2 values used in BEE_H are integrated with the results of the standard calculation using the previously mentioned 17 scoring items, and it is not possible to use each individual value separately.

2 Consideration of the Local Environment

2.1 Control of the burden on the local infrastructure

■ Assessment Item

Evaluate measures taken to control the burden on the local infrastructure at the time of occupancy.

■ Assessment Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	None of Efforts to be evaluated No. 1 through 6 have been implemented.
Level 3	One of Efforts to be evaluated No. 1 through 6 has been implemented.
Level 4	Two or three of Efforts to be evaluated No. 1 through 6 have been implemented.
Level 5	Four or more of Efforts to be evaluated No. 1 through 6 have been implemented.

Efforts to be evaluated

Classification	No.	Effort
Control of rainwater and wastewater loads	1	More than half of the external area is covered by planted areas (including ponds), permeable paving, or other water-permeable surface finishes in order to allow rainwater to permeate into the external area ground.
	2	An arrangement to allow rainwater to infiltrate into the ground, such as a soakaway or leaching trench, is installed to allow infiltration of rainwater that has fallen on the roof.
	3	A rainwater storage and utilization system is installed.
Control of domestic refuse load	4	Refuse treatment equipment is installed to reduce the amount of food scraps generated.
	5	A space for storing refuse by type is set aside inside the building or in the external area.
Others	6	Efforts other than those mentioned above have been implemented to reduce the load on the local infrastructure, such as the installation of a sewage treatment facility.

Availability of conditions for adding points:
*None

Level change according to conditions:
*None

Assessment not applicable:
*None

■ Description

1) Controlling the load of rainwater drainage

Infiltration of rainfall into the ground is an important measure to maintain the natural water circulation of the local region. Efforts evaluated include securing the external area, comprising the planted area or bare ground, so that it allows rainfall infiltration, and creating other systematic ways to allow rainfall to infiltrate using seepage pits and/or infiltration trenches.

In cases in which more systematic processes for rainwater drainage are necessary for reasons such as a high groundwater level (or cases in which it is judged that rainfall should not be allowed to infiltrate), rainwater conservation and/or use facilities are the only measure evaluated.

2) Controlling the load of domestic refuse

The subject of evaluation here is whether or not there are measures to control the amount of waste disposed of in daily life. With regard to raw garbage, the setting up of garbage processing facilities that reduce the amount of raw garbage is evaluated.

Raw garbage processing facilities:

Raw garbage processing facilities comprise composters (facilities that turn garbage into compost), raw garbage processing equipment, and disposers (limited to those equipped with a processing cistern and that do not discharge the residual matter into the sewers). However, when setting a composter outdoors, attention should be paid to the prevention of odors, insects, and rodents.

With regard to recyclable waste, the availability of space and facilities that allow for five or more different types of waste to be separated and stored is evaluated.

3) Others

Efforts other than those mentioned above to reduce the burden on the local infrastructure, such as sewage disposal facilities that reduce the regional sewage treatment load, are evaluated.

However, the scale and performance of sewage disposal facilities based on regulations and instructions in a locality undergoing sewage system improvement are not evaluated. Facilities with a purification performance significantly greater than that specified in the relevant guidelines are evaluated.

2.2 Preservation of the existing natural environment

■ Assessment Item

Evaluate measures taken to preserve the existing natural environment and natural resources such as the landscape, surface soil, trees and greenery, and use of local species.

■ Assessment Level

Level	Criterion
Level 1	No consideration has been given to preservation of the existing natural environment or natural resources.
Level 2	(No corresponding level)
Level 3	Ordinary consideration has been partly given to or ordinary actions have been partly taken for preservation of the existing natural environment or natural resources (one point or more).
Level 4	Ordinary consideration has been given to or ordinary actions have been taken for preservation of the existing natural environment or natural resources (two points or more).
Level 5	Almost no changes have been made to the existing natural environment and efforts have been actively implemented to preserve it (four points or more).

Efforts to be evaluated

No.	Effort	Points
1	<Preservation of the topographical features> The original topography is maintained without any change.	+1
2	<Preservation of the surface soil> The original topsoil is mostly maintained (including cases where the original topsoil was unsuitable for planting and was therefore covered with good soil).	+0.5
3	<Preservation of existing trees (medium-height and tall trees)> [1] The originally growing medium-height and tall trees (2 m or more) are maintained.	(per tree) +1
	<Preservation of existing trees (shrubs)> [2] The originally growing shrubs (less than 2 m) are maintained.	(per tree (plant)) +0.5
4	<Use of local species (tall trees)> More than half of newly planted tall trees are local (or indigenous) species.	+1
	<Use of local species (medium-height trees and shrubs)> More than half of newly planted shrubs are local (or indigenous) species.	+0.5

Availability of conditions for adding points:
*None

Level change according to conditions:
*None

Assessment not applicable:
*None

■ Description

In this section, efforts to preserve the existing natural environment and natural resources as much as possible are evaluated. The following efforts are evaluated:

1) Preservation of the topographical features

Even in the case of detached houses, it is not uncommon for large-scale land preparation work to be carried out when the site is located on sloping land. As the topographical features of the land form the basis for the local environment and local scenery, consideration should be given to avoid significant alteration of the existing topography. When acquiring vacant land and drawing up plans, it is desirable to investigate and confirm the state of preservation of the topographical features and surface soil of the site.

*Cases in which the topographical features are regarded as being preserved

- The previous topographical features have mostly been preserved after construction.
- Excavation underneath the building for unavoidable reasons during foundation work, etc. is acceptable.
- The alteration of small parts that face the road to create a driveway is acceptable.

*Cases in which the topographical features are not regarded as being preserved

- Construction is planned on acquired land that has been developed through large-scale land preparation work.

2) Preservation of the surface soil

Consideration should be given to the surface soil, which is the basis for the ecosystem as well as a crucial component of the natural environment, during the land preparation work and construction of the house. When acquiring vacant land and drawing up plans, it is desirable to confirm the state of preservation of the topographical features and surface soil of the site.

*Cases in which the surface soil is regarded as being preserved

- The previous surface soil remains after construction (including cases in which surface soil is temporarily removed during land preparation work but returned as the surface layer of the site).
- Excavation and removal of surface soil in the area underneath the building for unavoidable reasons during the construction of foundations, etc. is acceptable. (It is desirable to use this soil on the site as much as possible.)
- Excavation and removal of the surrounding surface soil when creating a retaining wall is acceptable. (It is desirable to use this soil on the site as much as possible.)
- When the existing surface soil is not of good quality, such as soil that inhibits plant growth, active improvement of the soil quality is regarded as "preserving" the soil.

*Cases in which the surface soil is not regarded as being preserved

- Construction is planned on acquired land that has been developed through large-scale land preparation work. (Cases in which land preparation work has been undertaken by a developer to preserve the surface soil are excluded.)

3) Preservation of existing trees

Existing trees on the site may have grown over a long time, and are an integral part of the longstanding local environment and regional scenery. Consideration should be given to preserving and taking over the care of these existing trees.

*Example of preservation of trees (*Quercus myrsinaefolia, Zelkova serrata*, etc.) at time of house renovation

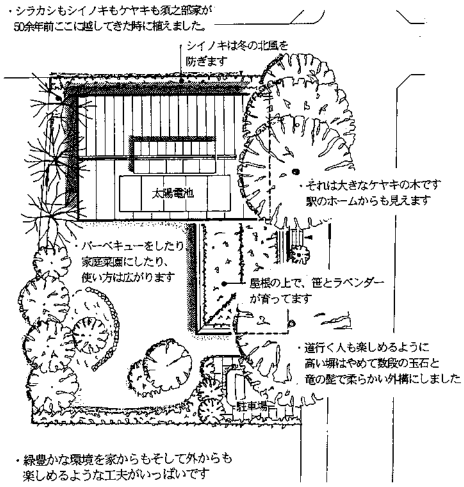


Photo and drawing courtesy of Iwamura Atelier

4) Use of local species (or indigenous species or local strains)

The use of tree species that are suited to the climate and natural features of the region in which the site is located allows the trees to fit into the local ecosystem, and can be regarded as stable greening that inherits the natural scenery of the region. Consideration should be given not only to the species of the trees, but to the sources of supply of trees and plants.

Trees and plants planted in the garden are generally selected by the owner of the property. It has been pointed out that some species from abroad and domestic plants transported long distances affect the local ecosystem. Therefore, when selecting trees and plants to be planted, consideration should be given to the use of local and indigenous species in order to preserve the region's ecological environment.

In a case in which the trees already planted on the site are preserved, the trees may be regarded as local species.

*Local species, indigenous species, and local strains

The terms "local species" and "local plants" refer to plants that grow naturally in the region. However, there is no strict definition, and these terms have been used with various meanings such as "indigenous species," "domestic indigenous species," and "local strains," described below.

The term "indigenous species" refers to species and subspecies as well as categories under subspecies that grow within a regional range where they are naturally found.

"Local strains" are part of a lineage that shares a common genetic pool of indigenous species in the region. This refers to a group that shares a genotype in addition to having similar or identical phenotypes and ecological niches, such as their forms and physiological characteristics.

(Source: "Recommendations on Handling of Greening Plants for Preservation of Biodiversity," The Japanese Society of Revegetation Technology)

*Methods of determining local species

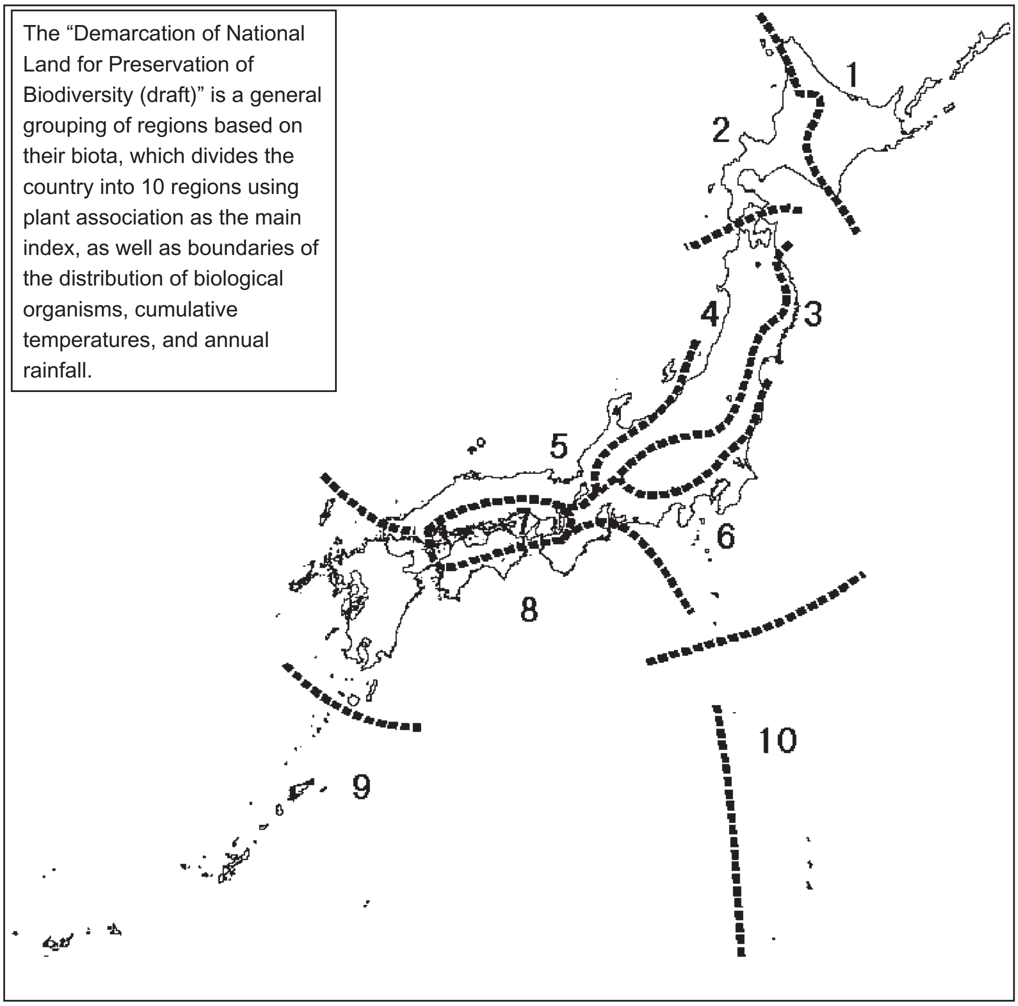
Local species can be determined by inquiring at the park- and greenery-related departments of the local municipal offices, asking gardeners, or checking publications such as local journals.

2

*Sources of seedlings

When it is difficult to obtain locally produced seedlings, they should desirably be obtained from the region in which the site is located by referring to the "Demarcation of National Land for Preservation of Biodiversity (draft)" shown below.

"Demarcation of National Land for Preservation of Biodiversity (draft)"
Ministry of the Environment



*Reference

"Recommendations on Handling of Greening Plants for Preservation of Biodiversity," The Japanese Society of Revegetation Technology
URL: http://wwwsoc.nii.ac.jp/jsrt/tech/teigen2002.html

3 Consideration of the Surrounding Environment

3.1 Reduction of noise, vibration, exhaust, and exhaust heat

■ Assessment Item

Evaluate efforts to reduce the effects on neighboring houses of noise, vibration, exhaust, and exhaust heat from outdoor equipment and machinery.

■ Assessment Level

Level	Criterion
Level 1	No particular consideration is given.
Level 2	(No corresponding level)
Level 3	Ordinary consideration is given to prevent sources of noise, vibration, exhaust, or exhaust heat from seriously affecting neighboring houses.
Level 4	In addition to Level 3 compliance, some actions are taken with respect to some sources of noise, vibration, exhaust, or exhaust heat.
Level 5	In addition to Level 3 compliance, actions are taken with respect to all sources of noise, vibration, exhaust, and exhaust heat.

Efforts to be evaluated

No.	Effort	
1	Control of noise or vibration sources	Reduction of noise or vibration is considered by the installation of low-vibration or low-noise type equipment, appropriate choice of installation locations, or provision of screens to reduce noise transmission with respect to noise or vibration generated from air-conditioner outdoor units, the hot-water supply system, and other units placed or installed outdoors.
2	Control of exhaust or exhaust heat sources	Measures are taken for the reduction of exhaust or exhaust heat, which may include the use of members that adjust the installation location or exhaust discharge direction or the installation of screens so as to prevent exhaust or exhaust heat generated from fuel-burning equipment or air-conditioner outdoor units from affecting neighboring houses.

Availability of conditions for adding points:
*None
Level change according to conditions:
*A case that there is no outdoor machinery (including exhaust outlets) is evaluated as level 5.
Assessment not applicable:
*None

■ Description

In this evaluation, the effects on neighboring houses of noise and offensive odors arising in daily life are excluded.

It is important that all of the items to be evaluated are set in locations that take the openings of major living spaces into consideration when there are houses in the surrounding area.

1) As a rough indication, "Ordinary consideration" in Level 3 means that the noise level at the boundary of the site from sources of noise and vibration is 45 dBA or lower. Regarding sources of exhaust and heat exhaust, consideration should be given so that no exhaust emissions or heat are discharged close to any openings of neighboring buildings.
2) An evaluation of Level 4 is given when, in addition to satisfying the criterion of Level 3, proactive efforts have been made for some types of equipment (Efforts to be evaluated No. 1 for sources of noise and vibration, and/or Efforts to be evaluated No. 2 for sources of exhaust and exhaust heat).
3) An evaluation of Level 5 is given when proactive efforts have been made for all equipment (Efforts to be evaluated No. 1 and 2).
4) Indicators of noise reduction methods in Efforts to be evaluated No. 1; i.e., provision of screens to reduce noise transmission, installation of low-vibration or low-noise type equipment, and appropriate choice of installation locations:
   - The sound level at the boundary of the site is maintained at 40 dBA or lower.

- Measures include the insertion of vibration-proof rubber to separate equipment and its base, and complete fixation of pipe arrangement supports to prevent sound resonance.
- Sound insulation walls.

5) Indicators of consideration for neighboring residences regarding exhaust and heat exhaust in Efforts to be evaluated No. 2:
- Outlets are placed in locations that do not emit exhaust or exhaust heat toward or around openings or inlet vents of neighboring buildings.
- Outlets are placed in locations where exhaust and exhaust heat do not affect plants in the site itself as well as in neighboring properties.

(Reference) Minimum Distance Required to Reduce Source Noise Level to 45 dB or 40 dB

The following formula is used for attenuation of a point sound source in relation to distance:

$$L = L_0 - 20 \times \log (r / r_0),$$

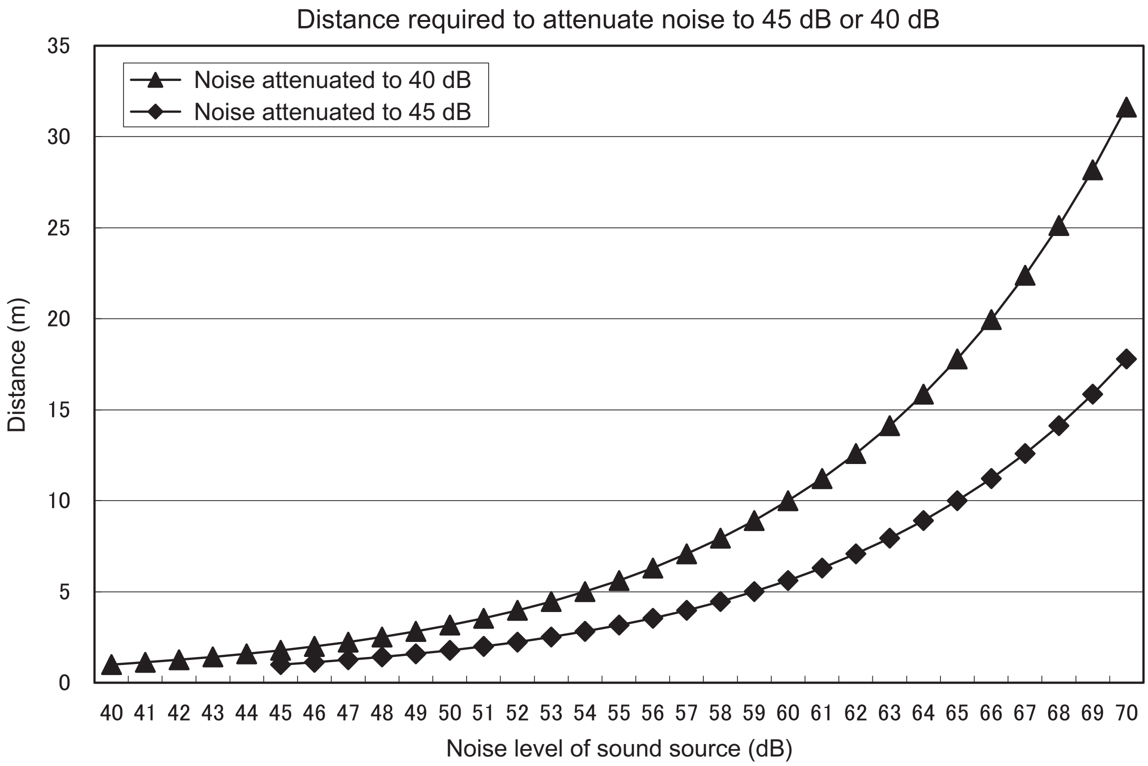
where L (dB) is the noise level at the sound-receiving point (a point located r meters from the sound source) and L0 (dB) is the noise level of the noise-generating equipment (at a point located 1 m from the sound source).

Therefore, the distance required to attenuate noise to 40 dB is

R (m) = 10^{(L_0 (dB) - 40 (dB))/20}.

In the same way, the distance required to attenuate noise to 45 dB is

R (m) = 10^{(L_0 (dB) - 45 (dB))/20}.



Attenuation of noise levels (reference values)

Noise level of equipment	45 dB	46 dB	47 dB	48 dB	49 dB	50 dB	65 dB
Distance required to attenuate noise to 40 dB	1.8 m	2.0 m	2.3 m	2.5 m	2.8 m	3.2 m	17.8 m
Distance required to attenuate noise to 45 dB	1.0 m	1.2 m	1.3 m	1.4 m	1.6 m	1.8 m	10.0 m

*Note that when multiple units of machinery are installed, the sounds are combined, making the noise level greater than in the case of a single unit.
*In the actual place of residence, reverberation may prevent attenuation from having the same effect, depending on the circumstances. It is therefore necessary to secure distances with some latitude.

3.2 Improvement of the thermal environment of the surrounding area

■ Assessment Item

Evaluate efforts to reduce the thermal effect on the surrounding environment.

■ Assessment Level

Level

Level	Criterion
Level 1	(No corresponding level)
Level 2	(No corresponding level)
Level 3	No special effort made
Level 4	One of Efforts to be evaluated No. 1 through 4 have been implemented.
Level 5	Two or more of Efforts to be evaluated No. 1 through 4 have been implemented.

Efforts to be evaluated

No.	Effort	
1	Some measures have been taken to reduce the thermal impact on the surrounding area so as to ensure smooth ventilation in the neighborhood.	[1] The building is set back in response to the prevailing wind direction in summer. Ratio of setback from the site boundary to the building height: 30% or more
2	The thermal impact on the surrounding area is reduced by maintaining a green area (including water surfaces) at the site (either [1] or [2] has been implemented).	[1] Efforts have been made to create as much shade from the sun as possible at the site by arranging medium-height/tall trees, piloti, eaves, or pergolas. Lateral projecting area: 20% or more
		[2] Rise of temperature on or near the ground surface is mitigated by arranging lawns, grass, shrubs, or ponds. Green coverage ratio: 10% or more
3	The thermal impact on the surrounding area is reduced by choosing the appropriate surface cover (either [1] or [2] has been implemented).	[1] The area of the ground covered by asphalt or concrete is reduced. Ground paved area ratio: less than 20%
		[2] Covering materials with good water retainability, water permeability, or sunlight reflectivity are used for the ground surface. Ratio of area covered by water-retaining and water-permeable pavement: 10% or more
4	The thermal impact on the surrounding area is reduced by choosing the appropriate exterior materials (either [1] or [2] has been implemented).	[1] Rooftop: Rooftop greening area, etc. ratio: 20% or more Or roofing materials with good sunlight reflectivity and longwave radiation efficiency are selected: 20% or more
		[2] Exterior wall surfaces: Ratio of green area to the total surface area of the exterior wall surfaces facing east, west, and south: 20% or more Or exterior wall materials with good sunlight reflectivity and longwave radiation efficiency: 20% or more

Availability of conditions for adding points:
*None

Level change according to conditions:
*None

Assessment not applicable:
*None

2

■ Description

Efforts that contribute to reduction of the thermal load outside the site are evaluated. The efforts that have been made are confirmed, and an assessment is conducted based on evaluation points.

1) Consideration is given to the area leeward of the site to reduce the thermal effect on the area outside the site.

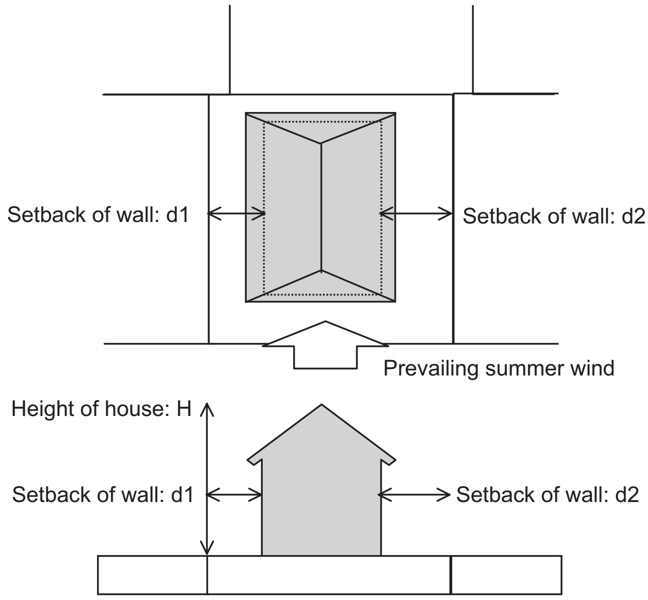
[1] The setback of the house from the prevailing wind direction (most frequent wind direction) in summer is evaluated.

Ratio of setback of wall:

(d1 + d2) / H ✕ 100% ≧ 30%

*d1, d2: Setback of walls directly facing the prevailing wind direction in summer

H: Maximum height of the house



*Methods of confirming the prevailing wind direction in summer:

(a) Use data from an observation point close to the site.
- An Automated Meteorological Data Acquisition System (AMEDAS) point
- Fire station, etc.

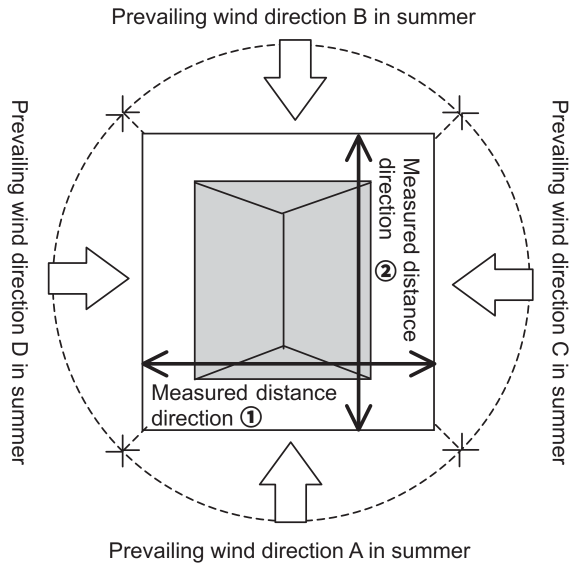
(b) When (a) is not available, regional meteorological data managed by the municipality can be used.

*Distance of wall used for evaluation

The wind direction and setback of the wall are set as shown in the diagram at right.

Wind direction: If the wind direction is at an oblique angle to the site or the building, the representative wind direction is determined within the area shown in the diagram (A, B, C, D).

Direction of measured distance: The direction that runs directly against the prevailing wind direction:
- ① when the prevailing wind direction is A or B, or
- ② when the prevailing wind direction is C or D.



2) A green area (including water surfaces) is secured on the site to reduce the thermal effect of the site on the surrounding area.

Efforts to secure shade to prevent heat accumulation from solar radiation on the building and the ground of the site are evaluated.

[1] Evaluation by the ratio of the lateral projecting area created by medium-height/tall trees, piloti, eaves, or pergolas to the total area of the site:

Ratio of lateral projecting area = {W ✕ (Lateral projecting area of medium-height/tall trees) + (Lateral projecting area of piloti/eaves/pergolas)} / Total area of site ✕ 100%

[2] Evaluation by the ratio of the green space to the total area of the site. The green coverage ratio includes the area of water surfaces such as ponds, as well as the ground surface covered by lawns, grass, shrubs, etc:

Green coverage ratio = (Green area + Water surface area) / Total area of site ✕ 100%

3) Consideration is given to ground covering materials to reduce the thermal effect of the site on the surrounding area.

Regarding the finish of the ground surface within the site, consideration should be given to the use of finishing materials that do not easily rise in temperature nor accumulate heat easily from sunlight during the day. In particular, when creating a parking space, consideration should be given to prevent the parking space from becoming a heat-accumulating area.

[1] Evaluation by the area covered by paving within the site (ground paved area ratio):

Ground paved area ratio = Ground paved area / Total area of site ✕ 100%

However, paved areas that obviously do not receive direct sunlight during the summer season can be excluded from the paved area.

[2] Evaluation by the ratio of the area covered by highly water-retaining and water-permeable pavement materials or the area paved with materials having high solar reflectance (low solar radiation absorption) to the total area of the site:

Ratio of area covered by water-retaining and water-permeable pavement, etc. =
Water-retaining and water-permeable pavement area or high-solar-reflectance (low-solar-radiation-absorption) pavement area / Total area of site ✕ 100%

4) Consideration is given to the roof materials and exterior surface materials of the house to reduce the thermal effect of the site on the surrounding area.

[1] Evaluation by the ratio of the area of greenery on the roof, or the area of roof materials having good sunlight reflectivity and longwave radiation efficiency, to the total roof area:

Rooftop greening area, etc. ratio = Total of green area of roof or area of roof materials having good sunlight reflectivity and longwave radiation efficiency / Total roof area ✕ 100%

[2] Evaluation by the ratio of the green area of the exterior wall surfaces, or the area of exterior wall surface materials having good sunlight reflectivity and longwave radiation efficiency, to the total exterior wall surface area:

Exterior wall surface greening area, etc. ratio = Total of green area of exterior wall surfaces or area of exterior wall surface materials having good sunlight reflectivity and longwave radiation efficiency / Total exterior wall surface area ✕ 100%

(Reference 1) Method of Grasping Wind Conditions around Planned Site

The ideal method would be to take actual measurements at the planned site, but in reality, on-site surveying is limited to cases such as environmental assessments for large-scale development projects. Therefore, meteorological data for the vicinity obtained from information sources such as those listed below are checked as much as possible instead. These information sources can provide details not only of wind direction but also various other meteorological data.

① "Most frequent wind directions by month" in statistical data and geographical data provided by prefectures and municipalities
- Directories and topography of prefectures and municipalities
- Prefectural white papers on the environment and prefectural programs regarding the environment
- Environment-related (environmental pollution) departments of prefectures and municipalities (Atmospheric observation data for environmental pollution measures may be available.)
  *Even when not listed in easily accessible statistical data catalogues, data may be available through inquiries at environment-related departments.

② Science Chronology (compiled by the National Astronomical Observatory of Japan): Data on most frequent wind directions by month for 80 major meteorological stations

③ Japan Meteorological Agency website (http://www.jma.go.jp/jma/index.html)

Top page: Click on "Meteorological statistics information" and "Search for past meteorological data."

Search for past meteorological data:
Click on "Selection of prefectures and subprefectural offices" under "Selection of data by location."

Selection of prefectures and subprefectural offices:
Click on the prefecture in the map.

Selection of location: Click on your target location in the map.

Search for past meteorological data-target location:
Click on your target data from "Selection of data" and "Selection of data type."

*Many observation points do not have monthly data on the most frequent wind directions.
*Keep in mind that data are for the selected year.
*On the chart, "Wind direction" on the right-hand side of "Maximum wind velocity" indicates the direction of the wind that recorded the maximum wind velocity (the same applies to "Wind direction" on the right-hand side of "Maximum instantaneous wind velocity"), and is not equivalent to the most frequent wind direction.
*Graphical display is also possible in addition to display in chart form.

Supplementary information: Observation data by hour for a specific day can be obtained by selecting "Values for every hour (of designated day)." Since hourly data are obtained for the wind direction and wind velocity as well, hourly data for several days can be checked to confirm the changes in wind direction and wind velocity within any given day of a season.

④ District Meteorological Observatory websites (One of the bases for ÖB Japan Meteorological Agency data)
- Sapporo District Meteorological Observatory (http://www.sapporo-jma.go.jp/)
- Sendai District Meteorological Observatory (http://www.sendai-jma.go.jp/)
- Tokyo District Meteorological Observatory (http://www.tokyo-jma.go.jp/)
- Osaka District Meteorological Observatory (http://www.osaka-jma.go.jp/)
- Fukuoka District Meteorological Observatory (http://www.fukuoka-jma.go.jp/)
- Okinawa District Meteorological Observatory (http://www.okinawa-jma.go.jp/)

Example) Tokyo District Meteorological Observatory (Monthly rates of appearance of wind directions for observation stations in the district)

Top page: Click on "Past meteorological data-rates of appearance of wind directions over 12 months."

Wind rose of district: Select and click on a spot near the planned site.

(Selected spot) Wind rose: Wind rose by month

Example) Tokyo District Meteorological Observatory (rates of appearance of wind directions in Tokyo for the past 5 years)

Top page: Click on "Data in Tokyo-rates of appearance of wind directions."

Rates of appearance of wind directions in Tokyo by month:
Select and click on a spot near the planned site.

(Selected spot) Wind rose: Wind rose by month for the past 5 years.

Example) Sendai District Meteorological ObservatoryÅiMonthly rates of appearance of wind directions for observation stations in the districtÅj

Top page: Click on "Regularly updated information-statistical data, seasonal phenomena."
Regularly updated information:
Click on "Normal values of meteorological statistical data (in Sendai District)."
Observed data monthly and yearly normal values:
Select and click on a spot near the location of the planned site.
(Selected spot) Surface weather observations; monthly and yearly normal values:
Most frequent wind direction.

Example) Osaka District Meteorological ObservatoryÅiMonthly rates of appearance of wind directions for observation stations in Osaka PrefectureÅj
Top page: Click on "Weather data-weather in Osaka Prefecture."
Weather in Osaka: Click on "Wind in Osaka Prefecture" and select season or month.
Wind in Osaka: Wind rose by month or season: Wind rose of various regions of Osaka by month or season.

Another way to check wind direction from a monthly or yearly report is to go to the websites of regional meteorological stations within a district, which can be accessed from the pages of the District Meteorological Observatory.

⑤ Fire station near the planned site
Some fire stations conduct weather observations and have observation data. In most cases, the data are not statistically processed, but some stations may send data by fax on request.

⑥ Environmental assessment data related to a large-scale development project in a nearby area
If the planned site is inside a large-scale housing development area or close to a large-scale development area, related environmental assessment data can be referred to.

(Reference 2) Water-Retaining and Water-Permeable Pavement

Water-retaining pavement refers to tiles, blocks, or bricks produced by burning coal ash or slag. These paving materials are capable of mitigating heat dispersion by retaining water, derived mainly from rainfall or watering, in their internal cavities, allowing it to evaporate into the atmosphere over a period of a few days and converting sensible heat emitted from the paving by the heat of evaporation into latent heat. Materials having this property are also being developed for use in buildings in addition to paving.

Water-permeable pavement is material that has a cross-sectional structure with continuous airspaces inside, allowing rainwater to permeate in the same manner as the natural ground does. This helps to recover the water circulation capability of ground that has been lost by the presence of buildings or ordinary asphalt paving, and can reduce the temperature of the paving surface as if water had been sprinkled over it by allowing water in the ground to evaporate on sunny days, thus removing the heat of evaporation. To ensure water permeability, not only the surface finish material but also the bottom layer needs to be permeable.

"Vegetation paving" formed by such methods as the planting of lawns is also evaluated as a permeable system.

The following websites provide relevant information (as of September 2007):

"Measures by Tokyo Metropolis against Heat Islands"
(Website of the Bureau of the Environment, Tokyo Metropolitan Government: http://www2.kankyo.metro.tokyo.jp/heat/)

"Guidelines for Designing the Environment of Buildings-Toward Environmentally Friendly Architecture"
(Housing Development Division, Osaka Prefecture http://www.pref.osaka.jp/koken/keikaku/kankyo/index.html)

Table: Examples of performance of water-retentive and water-permeable paving materials

Material	Use	Specific gravity	Water absorption (%)	Water retentiveness (liters/m²)	Water-permeability function	Remarks
Ceramic tile	Balcony	1.6	12-16	6.0-12.9		
	Veranda	1.6	12-15	6.0-10.5		
		-	-	2.0	○	In conjunction with the plastic frame
	Rooftop	1.6	12-16	6.0-12.9		
	Garage	1.6	12-18	10.0-18.5		
	Plaza	1.6	15	12.0		
	Sidewalk	1.6	13	14.8-19.8	○	
Ceramic	Parking	1.6-1.9	12-16	6.0-12.9		

block	Floor of greenhouse	1.9	12-15	10.0-12.0		Recycled waste glass
	Plaza	1.6	12-16	6.0-12.9		
	Sidewalk	1.6-1.9	12-18	10.0-18.5		
	Street	1.9	17.5	22.2-29.6		

* Water absorption (%) = Amount of water absorption / Absolute dry weight = [Water retentiveness (liters/m2) / (Thickness (m) x Specific gravity x 1000)] x 100

(Reference 3) Coating Materials and Building Materials with Good Sunlight Reflectivity and Longwave Radiation Efficiency

One of the major factors causing the heat island phenomenon is buildings and paving surfaces receiving heat from sunshine, thereby raising the temperature of the building frames and paving surfaces, with this heat either being discharged into the atmosphere in the daytime or accumulated inside and emitted in large amounts at night. As a solution, the use of coating materials and building materials with good sunlight reflectivity and longwave radiation efficiency is being promoted to prevent the exterior walls of buildings and paving surfaces from accumulating the heat of the sun.

Building materials with good sunlight reflectivity are those that efficiently reflect radiation in the near-infrared region in sunlight, thereby reducing the accumulation of heat in the materials of the building exterior or the external area in the daytime. Special pigments of the color materials contained in highly reflective paints reflect a large portion of the sunlight, preventing the increase of temperature on roof surfaces and the transmission of heat to building frames and interior spaces. Sunlight reflectivity varies depending on the paint color, and the level of effectiveness may also differ.

Building materials with good longwave radiation efficiency are those that emit a large amount of heat when heat is discharged into the atmosphere from roof surfaces where the temperature has been increased by sunlight. Highly emissive building materials discharge a large amount of heat into the atmosphere from the roofing materials and can therefore rapidly reduce the temperature of the roofing materials.

The following websites provide relevant information (as of September 2007):

"Measures by Tokyo Metropolis against Heat Islands"
(Website of the Bureau of the Environment, Tokyo Metropolitan Government: http://www2.kankyo.metro.tokyo.jp/heat/)

Guidelines for Designing the Environment of Buildings-Toward Environmentally Friendly Architecture
(Housing Development Division, Osaka Prefecture http://www.pref.osaka.jp/koken/keikaku/kankyo/index.html)
(Website of Committee to Promote Cool Roofs: http://www.coolroof.jp/)

Table Solar reflectance and longwave emissivity of roof and exterior wall materials

Material and finish		Sunlight reflectivity (ρ)	Longwave radiation efficiency (ε)
Nonmetal materials	Black asphalt, slate, paint, etc.	0.02~0.15	0.90~0.98
	Red-colored brick, tile, concrete, stone, etc.	0.2~0.35	0.85~0.95
	Yellow-colored brick, tile, concrete, stone, etc.	0.3~0.5	0.85~0.95
	White-colored brick, tile, concrete, stone, etc.	0.5~0.8	0.85~0.95
Metals	Galvanized sheet, polished iron sheet, matte brass, copper, aluminum, etc.	0.35~0.6	0.20~0.30
	Polished brass, copper, etc.	0.5~0.7	0.02~0.05
	Highly polished aluminum, tin plate, etc.	0.6~0.9	0.02~0.04
Coating materials	White paint	0.8	0.6
	Aluminum pigment	0.4	0.5
	Black ethylene propylene diene monomer (EPDM)	0.06	0.86

(References)
1) Jun Tanimoto, Aya Hagishima, et al: Development of enhanced water-retaining passive cooling bricks. Architectural Institute of Japan (AIJ) Journal of Architecture and Building Science, No. 11, 2000.
2) Harunobu Ashinaga et al: Development of methods for urban area heat environment planning using water-retentive building materials. The Society of Heating, Air-Conditioning and Sanitary Engineers of Japan, Lecture Collection, 1996.
3) Yukio Ishikawa: Research on water evaporation cooling effect of cool roofs utilizing heat-sensitive hydrogel–Heat performance measurement survey of cool roofs. Japan Solar Energy Society and Japan Wind Energy Association Collaborative Research Presentation Manuscript Collection, 2004.
4) Kazuhiro Komoto: Survey on the moderating effect of high-reflectance coating materials/water-retentive building materials on the heat island phenomenon. Tokyo Municipality Heat Island Symposium material, July 2004.
5) ASHRAE Guide and Data Book Equipment 1969. American Society of Heating, Refrigerating and Air-Conditioning Engineers.
6) Pacific Gas and Electric Company: High Albedo Roofs (Codes and Standards Enhancement Study), 2000.

Part III

Commentary on CASBEE for Home (Detached House) with Reference Documents

1 Commentary on CASBEE for Home (Detached House)

1.1 Measures for Promotion of Sustainability

The development and diffusion of specific technological as well as political means to promote sustainability is urgently required in the construction field, which consumes and disposes of large amounts of resources and energy. Measures to promote sustainable buildings may include education on environmental architecture, provision of relevant information, and restrictions by laws and regulations, but the most effective means is considered to be the introduction of a market mechanism based on an evaluation system. In fact, amid the spreading movement toward the promotion of sustainable building since the latter half of the 1980s, BREEAM (the Building Research Establishment Environmental Assessment Method*[1]), LEED™ (Leadership in Energy and Environment Design*[2]), the GB Tool (Green Building Tool*[3]), and many other techniques for assessing the environmental performance of buildings have been attracting global attention. The implementation of such assessment and disclosure of its results are now regarded as one of the most promising incentives for the ordering parties, owners, architects, and users of buildings to promote the development and diffusion of highly sustainable construction practices.

CASBEE was developed based on the following basic policies:

(1) The focus of assessment should be on excellence of environmental design and enhancement of incentives for architects.
(2) The assessment system should be as simple as possible.
(3) The assessment system should be applicable to buildings in a wide range of applications.
(4) The system should take into consideration issues and problems peculiar to Japan and Asia.

1.2 Overview of CASBEE and Positioning of CASBEE for Home (Detached House)

CASBEE has four basic tools corresponding to the life cycle of buildings and extended tools to meet specific purposes, all of which are collectively called the "CASBEE Family." The four basic tools are "Pre-design," "New Construction," "Existing Building," and "Renovation," each of which is applied depending on the stage and purpose of evaluation. The extended tools include CASBEE for HI (Heat Island), which assesses efforts to mitigate the heat island phenomenon; CASBEE for Urban Development, to assess urban areas and communities; CASBEE for Temporary Construction, to assess temporary buildings such as world exposition pavilions; and the newly developed CASBEE for Home (Detached House), which corresponds to one of the four basic tools, namely, CASBEE for New Construction.

For residential buildings, the already published CASBEE editions for New Construction, Existing Building, and Renovation can be used to assess medium- and high-rise apartment buildings but are not applicable to low-rise apartment buildings and detached houses. The newly developed tool is for detached houses (dedicated dwellings). We are planning to develop versions for houses for other purposes, and intend to integrate the versions for these houses and establish a single edition, "CASBEE for Home," in the future.

*[1] Building Research Establishment Ltd. (1990)
*[2] U.S. Green Building Council (1997)
*[3] Green Building Challenge, Natural Resources Canada (1998)

Table 3.1 Four basic tools of CASBEE

Basic tool	Pre-design	Design	Post-design		
			Construction	Operation	Renovation
Pre-design	Pre-design assessment				
New Construction		Assessment of newly constructed buildings Subject of CASBEE for Home (Detached House)			
Existing Building				Assessment of existing buildings	
Renovation					Assessment of renovation

Table 3.2 List of CASBEE applications

Application category		Use	Specific applications	
Nonresidential use		Offices, etc.	Offices, government buildings, libraries, museums, post offices, etc.	Completed
		Schools	Elementary schools, junior high schools, high schools, universities, specialized vocational high schools, higher vocational schools, schools in miscellaneous categories	Completed
		Retailers	Department stores, supermarkets, etc.	Completed
		Eating and drinking establish-ments	Restaurants and other eating establishments, coffee shops, etc.	Completed
		Meeting places	Public halls, meeting halls, bowling arenas, gymnasiums, theaters, movie theaters, *pachinko* (pinball) parlors, etc.	Completed
		Factories, etc.	Factories, garages, warehouses, auditoriums, wholesale markets, etc.	Completed
Residential use		Health facilities	Hospitals, homes for the aged, welfare facilities for the handicapped, etc.	Completed
		Hotels	Hotels, Japanese-style inns, etc.	Completed
	Planned to be integrated into "CASBEE for Home"	Collective housing	Collective housing (medium- and high-rise)	Completed
		Collective housing	Collective housing (low-rise)	Future plan
		Detached houses	Detached houses (for residence)	Newly published
		Detached houses	Detached houses (dual-purpose houses, tenement houses)	Future plan

1.3 Background of CASBEE Development

(1) Historical view of environmental efficiency assessment

1) Environmental efficiency assessment Stage 1

The oldest form of environmental efficiency assessment of buildings introduced in Japan was mainly intended to evaluate the indoor environmental performance of a building; in other words, it was basically a system aimed at improving living amenities or benefits for building users. This type of assessment may be recognized as the first stage of environmental efficiency assessment of buildings. This stage generally considered the local or global environment as an open system and did not place much attention on the environmental load imposed on the external world. The principle on which this early stage of environmental assessment was based was therefore rather simplistic.

2) Environmental efficiency assessment Stage 2

With the dawn of the 1960s, the general public in urban areas of Japan including Tokyo developed a growing interest in air pollution, building wind (street-level wind caused by high-rise buildings), and other environmental phenomena, and the response to these problems was transformed into and became established in society as a system of environmental impact assessment. The new version of environmental assessment incorporated the viewpoint of environmental load for the first time. This marked the second stage of environmental efficiency assessment of buildings. To be specific, second-stage systems evaluated only the negative impacts ("urban pollution") that buildings had on their surroundings, such as building wind or obstructed sunlight as environmental impacts (that is, environmental loads). In other words, the subject of the first-stage assessment was the environment as private property, while that of the second-stage assessment was the environment as public (or non-private) property.

3) Environmental efficiency assessment Stage 3

Environmental efficiency assessment further evolved into the third stage when the global environment became an issue from the 1990s. A number of specific techniques in this stage have been proposed based on large volumes of research results, including BREEAM, LEEDTM, and the GB Tool. These techniques are being rapidly disseminated in society, mainly in advanced countries, and are being applied as techniques for environmentally friendly design or environmental labeling (rating) in various countries.

The major focuses of assessment in this stage are negative aspects of the act of construction. In other words, the aspect of environmental impacts or loads that a building has on the environment during its life cycle, or life cycle assessment (LCA), is newly taken into consideration. On the other hand, the third-stage assessment also includes the conventional type of environmental efficiency of buildings as the first-stage assessment did. What needs attention here is that none of the above assessment tools intentionally distinguish the basic differences between the two characteristically different subjects of assessment. To be specific, one can find in these assessment systems conceptually different assessment items side by side with no clear definition of the ranges (boundaries) of the subjects of assessment. Seen in this light, the principle of assessment systems in the third stage expands the variety of assessment subjects compared with the first- and second-stage systems, but has a drawback in that there is increased ambiguity of the basic framework of environmental efficiency assessment.

4) Environmental efficiency assessment Stage 4: Comprehensive assessment of environmental efficiency of buildings based on a new concept

Under the above circumstances, CASBEE has been developed based on the understanding that it is necessary to restructure the framework of the existing environmental efficiency assessment into a simpler and clearer system from the viewpoint of sustainability. The development of the third stage of environmental efficiency assessment was initiated out of the recognition that, in the first place, the environmental capacity of our region or our planet has reached its limits. It therefore became apparent that the concept of a closed system that can determine environmental capacity for assessment of the environmental efficiency of buildings must be proposed in the system of the new stage. Thus, CASBEE proposed a virtual closed space divided by the boundary of the building site or the maximum height, shown in Fig. 3.1, as a closed system for the environmental evaluation of buildings. The space in the compound demarcated by the virtual boundary can be controlled by the owner, architect, and other stakeholders involved, while the space outside is public (non-private) and for the most part cannot be controlled.

The environmental load is an environmental factor defined under the above concept as "a negative aspect of the environmental impact a building has on the virtual closed space as well as on the outside space (public environment) beyond that closed space." Improvement of quality or functionality inside the virtual closed space is defined as "improvement of the living amenities for building users." The environmental efficiency assessment system in the fourth stage focuses on both of these aspects and defines and assesses them differently. This then clearly explains the principle of assessment. The new concept described here is the basis of the framework of CASBEE.

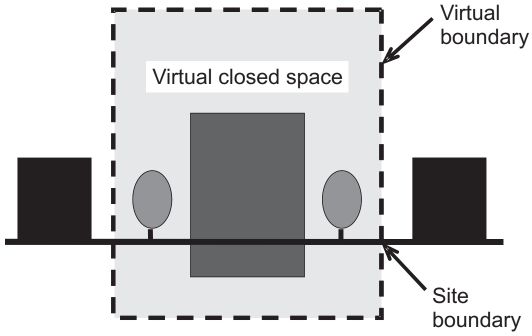


Fig. 3.1 Virtual closed space demarcated by the site boundary

(2) Shifting from eco-efficiency to building environmental efficiency (BEE)

CASBEE introduced the concept of "eco-efficiency" to make a comprehensive evaluation of the two factors; namely, inside and outside the building site. Eco-efficiency*[4] is generally defined as the value of a product or service per unit environmental load. As "efficiency" is often defined in terms of the relationship between input and output, we can broaden the definition of eco-efficiency and propose a new version of the definition: "(Productive output) divided by (Input plus Nonproductive output)." As indicated in Fig. 3.2, we created a new term, "building environmental efficiency (BEE)," out of this new model of environmental efficiency and used it as the assessment indicator for CASBEE.

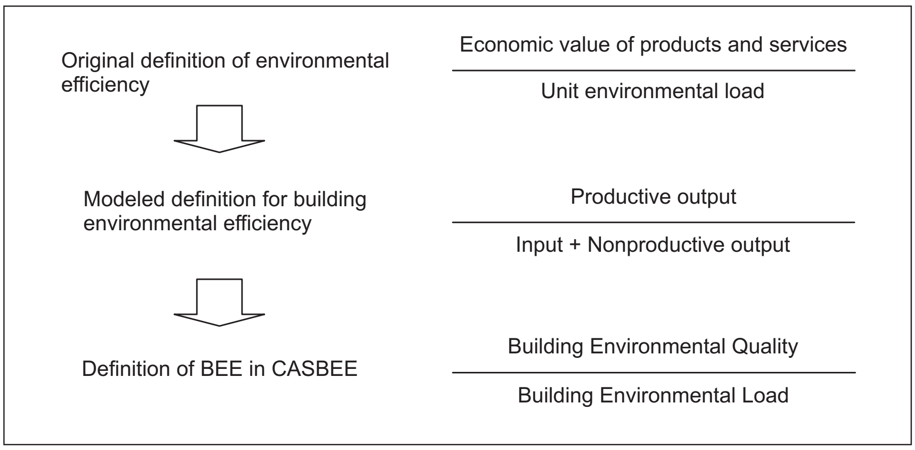


Fig. 3.2 Development of BEE from the concept of eco-efficiency

*[4] World Business Council for Sustainable Development (WBCSD)

1.4 Mechanism of Assessment by CASBEE for Home (Detached House)

(1) Two fields of assessment: Q_H and L_H

In CASBEE for Home (Detached House), as mentioned earlier, space is demarcated by the "virtual boundary" defined by the site boundary, etc., and divided into two spaces: the inside and outside of the virtual boundary. This virtual boundary is referred to as the "demarcation for assessment of Q and L." CASBEE for Home (Detached House) simultaneously takes into consideration two factors related to these two spaces, namely, "negative aspects of the environmental load affecting the outside (public environment) beyond the demarcation for assessment of Q and L," and "improvement of living amenities for occupants inside the demarcation for assessment of Q and L," and proposes a mechanism for the comprehensive assessment of the environmental efficiency of buildings. CASBEE for Home (Detached House) defines these two factors, referred to as the major assessment categories QH and LH, as shown below, and evaluates each of them separately.

- Q_H (Quality): Environmental quality of homes
  In this category, a house is evaluated in terms of "improvement of living amenities for occupants inside the demarcation for assessment of Q and L."
- L_H (Load): Environmental load of homes
  In this category, a house is evaluated in terms of "negative aspects of the environmental load affecting the outside (public environment) beyond the demarcation for assessment of Q and L."

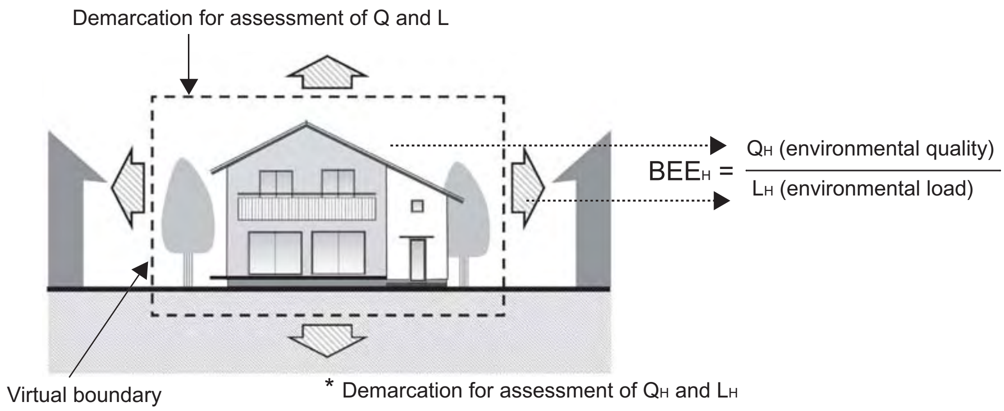


Fig. 3.3 "Demarcation for assessment of Q and L" in CASBEE for Home (Detached House)

(2) Assessment subjects of CASBEE for Home (Detached House)

Each of Q_H and L_H in CASBEE for Home (Detached House) has three categories of evaluation. In each such category, specific efforts made or measures taken in relation to the assessed house are evaluated.

Environmental quality (Q_H) is assessed in the following:

Q_H1 Comfortable, Healthy, and Safe Indoor Environment
Q_H2 Ensuring a Long Service Life
Q_H3 Creating a Richer Townscape and Ecosystem

Efforts or measures to mitigate the environmental load (L_H), or for load reduction (LR_H), are assessed in the following:

LR_H1 Conserving Energy and Water
LR_H2 Using Resources Sparingly and Reducing Waste
LR_H3 Consideration of the Global, Local, and Surrounding Environment

CASBEE for Home (Detached House) evaluates houses in these categories; houses that receive a high evaluation are those that are comfortable, healthy and safe (Q_H1), ensure a long service life (Q_H2), conserve energy and water (LR_H1), incorporate measures to reduce the environmental load so as to produce the smallest amounts of waste when being constructed or demolished (LR_H2), and contribute to the development of a good local environment (Q_H3 and LR_H3).

(3) Environmental labeling based on building environmental efficiency (BEE_H)

As summarized in the previous section, building environmental efficiency based on the two assessment categories Q_H and L_H (BEE_H) forms the primary concept of CASBEE. For the purpose of this evaluation system, BEE_H is an indicator derived by calculating Q_H (environmental quality of the home) as the numerator and L_H (environmental load of the home) as the denominator:

$$\text{Building environmental efficiency } (BEE_H) = \frac{Q_H \text{ (environmental quality of home)}}{L_H \text{ (environmental load of home)}}$$

The use of BEE_H allows more concise and clearer presentations of the results of building environmental efficiency evaluations. When Q_H is plotted on the vertical axis against L_H on the horizontal axis, the BEE_Hevaluation result will be shown as the gradient of a straight line connected to the origin (0, 0). A sharper gradient indicates higher Q_H and lower L_H, denoting that the building is more sustainable. This technique realizes a presentation of the building environmental efficiency assessment results in terms of ranking based on the area divided by the slope of the line. In a graph, a building may be graded as Rank C (poor), Rank B$^-$, Rank B$^+$, Rank A, or Rank S (excellent) as the BEE_H score increases.

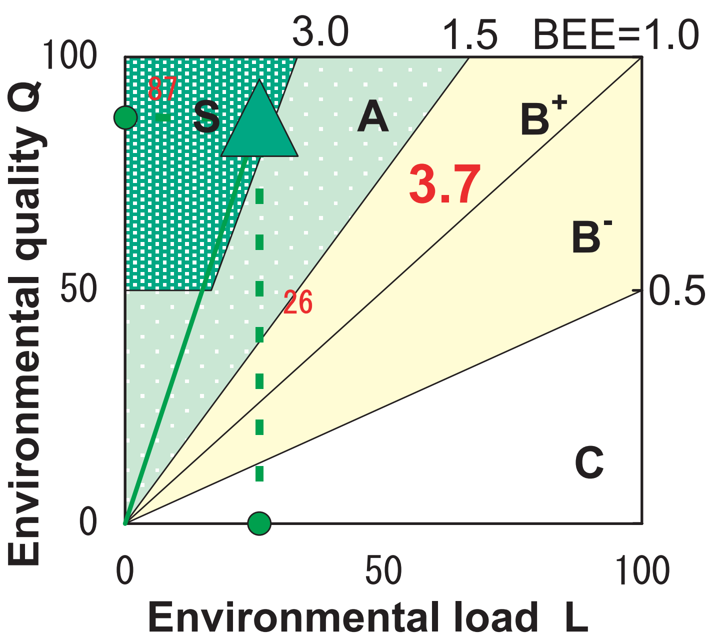


Fig. 3.4 Environmental labeling based on BEE_H

1.5 Basic Concept of Range of Assessment by CASBEE for Home (Detached House)

CASBEE for Home (Detached House) is a tool that focuses on the environmental efficiency of a detached house and makes a comprehensive assessment of the house. Therefore, it is not intended to evaluate all of the aspects of performance and quality related to a house. In particular, aesthetics and cost are ruled out as assessment subjects of CASBEE as they are considered to be within the scope of their respective evaluation systems that have already been separately established.

Aesthetics:
Although a house needs to be aesthetically attractive in terms of its appearance and indoor space, "beauty" itself is difficult to judge in an objective manner and is thus excluded from the scope of evaluation. "Q_H3.1 Consideration of the Townscape and Landscape" also presents a similar difficulty in evaluation; in this case, however, it has been decided that assessment can be made under the condition that only items that can be evaluated in a relatively objective manner are applicable.

Cost:
The cost of a house may increase with efforts to raise the CASBEE evaluation score (as various measures are adopted), and cost is therefore an important issue. However, since it is understood that the evaluation of cost-effectiveness is a matter of the individual's judgment, it is also excluded from the scope of CASBEE evaluation.

Individual lifestyle or preferences:
Detached houses are often designed to match the occupants' lifestyle or preferences and, when completed, can satisfy the occupants' requirements in this regard. However, this element is basically a matter of the individual's subjective feelings and defies objective judgment, so in principle it is excluded from consideration by CASBEE. Nevertheless, some items that are considered to have a significant impact on the building's environmental performance and allow relatively clear-cut evaluation are included as subjects of evaluation.

1.6 Utilization of CASBEE for Home (Detached House)

CASBEE for Home (Detached House) is ideal for use in the following four applications:

① As a tool to realize environmental design for new houses
Architects can make a comprehensive review of the environmental efficiency of houses that they are designing using CASBEE for Home (Detached House), setting goals for environmental efficiency and checking the level of attainment, thereby ultimately realizing appropriate design for the environment.

② As a tool to communicate with house owners, architects, and builders
Another effective use of CASBEE for Home (Detached House) is as a communication tool that helps owners, architects, and builders to thoroughly discuss architectural designs and techniques so as to enhance housing environmental efficiency. CASBEE not only evaluates the specifications of houses but also covers such elements as home electric appliances brought in by the occupants and the provision of information to the occupants. It allows building owners and their architects to make appropriate evaluations of the environmental efficiency of their houses while visualizing how their houses will be used or how the occupants will use the houses.
CASBEE may also be used by housing suppliers as a tool to form a consensus in the design stage or by architects as a tool to explain the principles and concepts of their designs to the contractors.

③ As an environmental labeling tool
When housing suppliers, local governments, or nonprofit organizations (NPOs) intend to sell or diffuse detached houses with superior environmental efficiency, they will be able to use the performance ranking results derived from CASBEE for Home (Detached House) to provide consumers with an easy-to-understand account of the houses' environmental performance.

④ Application to private financial institutions
Since CASBEE for Home (Detached House) assesses houses in terms of a wide range of efforts related to environmental factors, it can be used by financial institutions as a reference material that helps them judge whether to provide house purchasers with loans or preferential interest rates. Moreover, as CASBEE also

assesses the life cycle CO_2 of houses and presents the results obtained, its use will contribute to the prevention of global warming by promoting the dissemination of environmentally friendly houses.

1.7 Compliance with ISO/TS 21931-1

Since 1997, the International Organization for Standardization (ISO) has been promoting international standardization of sustainable construction and building. Technical Specification ISO/TS 21931-1, which regulates the framework for building environmental efficiency evaluation, was issued in March 2006.

The effective period of this TS is set at two years after its issuance according to the ISO regulations. Although the TS is a public document, it does not have binding power as an ISO standard version, and compliance with the TS is voluntary by nature. The compliance of CASBEE with the TS will provide a number of benefits, including enhanced reliability of CASBEE and acquisition of the basis for mutual certification with other assessment systems in the world. This will be of great significance, particularly as regards the realization of a third-party certification system. Although a third-party certification system is a future task to be tackled, we have decided to have CASBEE for Home (Detached House) comply with the said TS.

Reference: Outline of ISO/TS 21931-1
Official name: Sustainability in building construction-Framework for methods of assessment for environmental performance of construction works; Part 1: Buildings
Effective period: Two years from March 1, 2006 (issuance of the first version)
Purpose: To provide the framework and basic rules for environmental performance evaluation of newly constructed and existing buildings by considering various impacts that buildings have on the environment

① Requirements of the Technical Standard and CASBEE for Home (Detached House)

Table 3.3 compares the requirements of the TS, the corresponding parts of CASBEE for Home (Detached House), and the corresponding descriptions in other assessment manuals, etc. The contents shown in the "Corresponding descriptions in other assessment manuals, etc." column are those that are particularly required for third-party certification (note that self-evaluated CASBEE assessment is not required to have any correspondence as in this table).

Table 3.3 Requirements of ISO/TS 21931-1 and corresponding parts of CASBEE for Home (Detached House)

Documentation requirements of ISO/TS 21931-1 Numbers in ( ) indicate the section number in the TS.	Corresponding part in the CASBEE Assessment Manual	Corresponding part in the CASBEE Assessment Software	Corresponding descriptions in other assessment manuals, etc.
(1) Requirements concerning organization	"Introduction" and "Afterword"	-	
(2) Requirements concerning assessment methods			
Intended use of method (5.2)	3. How to Use CASBEE for Home (Detached House), Part I 1.6 Utilization of CASBEE for Home (Detached House), Part III	-	
System boundary (5.3)	2.1 Basic Structure of Assessment, Part I 1.4 Mechanism of Assessment by CASBEE for Home (Detached House), Part III	-	
Statement of assumptions (5.4)	1.5 Points to Note about Publication of Assessment Results, Part I 3.3 Rules for Presentation of Assessment Results, Part I 3.3 Rating Criteria, Part II	Main sheet Scores sheet Results sheet	Description of assumption conditions by the assessor
Structured list of issues	2.2 Assessment Items, Part I	Scores sheet	

for environmental assessment (5.5)	3. Rating Criteria, Part II		
Methods for quantification of environmental performance (5.6)	2.1 Basic Structure of Assessment, Part I 2.3 Point Allocation (Weighting) Policy, Part I Part II Assessment Method of CASBEE for Home (Detached House) 2. Life Cycle CO_2, Part III	Weightings sheet CO2 data sheet Scores sheet CO2 calculation sheet	
Sources of information (5.7)	3.3 Rating Criteria (commentative part), Part II 2. Life Cycle CO_2, Part III 3. Reference Informati1on, Part III	CO2 data sheet Scores sheet CO2 calculation sheet Considerations sheet	Documents that serve as a basis for the assessed building
Evaluation and interpretation (5.8)	2.2 Assessment Items, Part I 1. Basic Policy of Assessment, Part II 2. Assessment Method, Part II 1.4 Mechanism of Assessment by CASBEE for Home (Detached House), Part III	-	
Reporting of assessment results and report format (5.9)	-	All	Demonstration of compliance with the specification

② Required assessment items of the Technical Standard and CASBEE for Home (Detached House)

The TS includes such assessment items as environmental impact, environmental aspects, maintenance, and indoor environment together with the life cycle aspects for each item. Of these items, those that are mandatory are shown in Table 3.4. If any of these items is not evaluated by a certain assessment system, the TS requires the system to show why the item has been excluded. Note that these mandatory items are not necessarily required to be evaluated by quantitative indicators. In CASBEE, the following descriptions are added to the Manual.

● Destruction of the ozone layer

Building materials including foamed insulation materials generally used for detached houses do not contain chlorofluorocarbons, a source of ozone layer destruction. Therefore, CFCs are not an item of assessment.

● Soil and groundwater (environmental aspect b): Impacts on the local environment)

There is a small possibility that detached houses constructed in compliance with the applicable laws and regulations could contaminate the soil or groundwater. Compliance with the applicable code for construction of detached houses is also a prerequisite of assessment by CASBEE.

● Odors

Odors from detached houses are not covered by law. Such odors are judged to have a minor impact, if any, on the surrounding environment from the perspective of environmental load and are therefore not an item of assessment.

Table 3.4 Mandatory assessment items in ISO/TS 21931-1 and corresponding assessment items of CASBEE for Home (Detached House)

	Mandatory assessment items in TS	Corresponding assessment items in CASBEE	Remarks
Environmental impacts	- Climate changes - Ozone depletion	$LR_H3.1$	Ozone layer destruction is not an item of assessment, based on the recent trends in distribution of thermal insulating materials in the market.
	a) Flow of life cycle energy and materials 1) Use of raw materials	$LR_H2.1$	

Environmental aspects	- Decrease of nonrenewable raw material resources - Use of nonrenewable raw material resources - Use of hazardous or toxic materials		
	2) Primary energy use - Reduction of nonrenewable primary energy - Use of nonrenewable primary energy	LR_H1	
	3) Use of water	$LR_H1.3$	
	4) Use of land	Q_H3	
	5) Categories: - Reuse, recycling, energy recovery - Generation of waste requiring final disposal	 $LR_H2.1$, $LR_H2.3$ $LR_H2.2$	
	b) Impacts on the local environment 1) Soil 2) Groundwater 3) Noise 4) Odor	$LR_H3.3.1$	Soil and groundwater are not items of assessment because legal compliance is a requisite of assessment. Odors from detached houses are not evaluated because they are judged to have a minor impact, if any, on the environment.

2 Life Cycle CO_2

2.1 What is Life Cycle CO_2?

It is important to evaluate a house in terms of its whole service life, from construction to demolition ("life cycle"), in order to assess the impact of the house on the global environment. Among the various impacts on the global environment, global warming has become one of the most serious issues we face today. The generally accepted technique to measure the contribution of a house to global warming is to calculate the total emissions of CO_2, a representative global warming gas, of the house. The total amount of CO_2 emissions from a house during its service life is referred to as "life cycle CO_2."

The life cycle of a house is divided into several stages, including construction, occupancy, renewal, demolition, and disposal. Each stage affects global warming, and such impacts should be calculated in total. For example, during the construction stage, energy is expended in the production of building materials to be used at the construction site, transportation of these materials to the site, and use of construction machinery at the site. During the occupancy stage, energy is consumed by air conditioning, hot-water supply, cooking, lighting, and the use of various household electric appliances. When the house is renovated once in a decade or so, the production of newly added building materials or disposal of removed materials require the consumption of energy. When the house is finally demolished, the demolition work and disposal of demolished materials use energy. All of these energies expended in the life cycle of the house are added together and converted to the total amount of CO_2 emissions, which is the life cycle CO_2*, so as to measure the impact of the house on global warming.

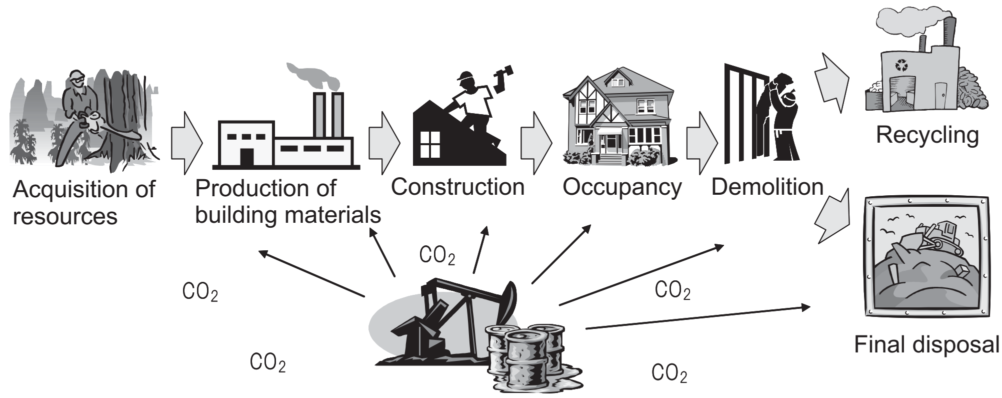


Fig. 3.5 CO_2 emission stages in the life cycle of a house

In the life cycle CO_2 of a house, the stage that has the largest impact within a short time is construction. The majority of CO_2 emissions during construction are from energy expended on the production of building materials. Iron and concrete, for example, are produced with the expenditure of a huge amount of energy, far greater than the energy spent on transportation or construction. On the other hand, CO_2 emissions during occupancy are mostly from daily use of electricity, gas, water supply, and sewerage. The annual total of such emissions is extremely small when compared with the CO_2 emitted during construction. When viewed in terms of the life cycle, however, the emissions during occupancy are far larger than those during construction. Take, for example, the data of a typical house with a service life of 30 years shown as reference data for the calculation method in CASBEE for Home (Detached House). The total CO_2 emissions during occupancy account for 70% of the total life cycle CO_2 emissions (See Fig. 3.6). The ratio increases as the service life of the house becomes longer. Therefore, reducing the life cycle CO_2 of a house definitely requires control of energy consumption during occupancy.

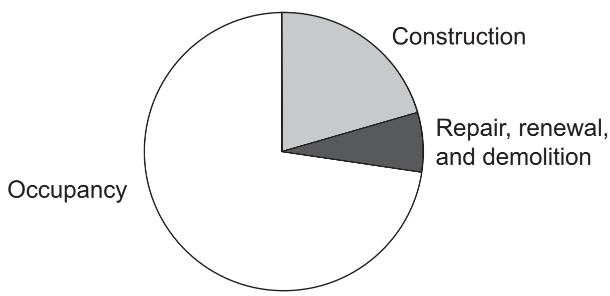


Fig. 3.6 Breakdown of the life cycle CO_2 of a house

If a house is provided with highly efficient thermal insulation in order to reduce the cooling and heating energy consumption, its CO_2 emissions during occupancy will be reduced. However, the CO_2 emissions during its construction will increase because of the additional energy used for production and transportation of the insulation material. Accurate measurement of the contribution made by highly efficient thermal insulation to the reduction of global warming requires attention to this trade-off relationship. In this sense, evaluation in terms of the life cycle is quite significant.

That being said, it is difficult to accurately measure the life cycle CO_2 of a house. It is necessary to check the energy consumed for the production of the large number and variety of parts, members, and materials used to build a house and for their transportation and construction work. It is also very difficult to determine in advance how the occupants will live in the house or use each specific piece of equipment in the future, which is necessary to calculate energy consumption during occupancy. Moreover, the building service life is at best merely an estimation.

In addition, when energy consumption is converted to CO_2 emissions, the "CO_2 emission unit" is necessary as a coefficient. Several versions of this coefficient have been released so far, and it is necessary to select the appropriate one depending on the purpose of calculation. Not all materials have the appropriate basic unit, and almost no such basic units intended for general users have been disclosed, particularly with regard to recycled materials or new energies.

As explained above, it is difficult to obtain accurate values, but it is possible to calculate the values for a house if it is assumed that it is used in a normal manner and has a normal service life. Hence, the life cycle CO_2 used by CASBEE for Home (Detached House) can be understood as indicating the capability of an assessed house to control the impact that it has on global warming, assuming a certain way of use.

* Most greenhouse gas emissions in the private household category consist of energy-generated CO_2. It was therefore decided to include energy-generated CO_2 alone in the scope of evaluation.

2.2 Basic Policy for Life Cycle CO2 Evaluation in CASBEE for Home (Detached House)

The work of evaluating the life cycle CO_2 of a house generally requires a tremendous amount of time and labor. Taking the construction stage, for example, it is necessary to consider all of the materials that constitute a house. To be specific, we need to investigate the types and quantities of energy resources used in the acquisition, transportation, and processing of resources that make up the building materials, and add up the results obtained for each of these values multiplied by the CO_2 emission unit (CO_2 emission per unit energy consumption) for each type of energy. Then we need to go to the construction stage, calculating the CO_2 emissions corresponding to the energy consumption and adding them to the above results. The same procedure has to be repeated for all other stages to calculate the life cycle CO_2 for that house.

Specialized or professional knowledge may be required when gathering all of these different types of information or setting the assessment conditions. In addition, each house is different from any other in terms of its constituent members, location, usage, and other factors, making it necessary to perform this life cycle CO_2 evaluation for each house. It would be very difficult for many users of CASBEE for Home (Detached House) to carry out such work in the design and construction stages.

As a solution, we have adopted the following approach for simplified evaluation:

① To minimize the workload on users of CASBEE for Home (Detached House) when carrying out the assessment work, an evaluation approach is employed that does not require information gathering or condition setting specifically for the determination of life cycle CO_2 but can automatically calculate it from the results of other scoring items, particularly those related to CO_2 emissions.

② Since the above approach limits the items of assessment to those that are both assessable and significant, it allows the presentation of life cycle CO_2 for the primary purpose of informing users of the rough values of CO_2emissions and CO_2 reduction effects, although this simplified technique does not evaluate all measures or efforts related to life cycle CO_2.

Some users well versed in life cycle CO_2 evaluation may wish to perform evaluation based on their own calculations. At the present time, however, there are no established techniques for evaluation of the life cycle CO_2 of houses, and if users' individual calculations were allowed, various results having different prerequisites would become intertwined in the assessment of houses. This could cause a loss of reliability of not only the resultant life cycle CO_2 values but also of BEE_H assessments using such results. Considering this, it has been decided as a principle of CASBEE for Home (Detached House) to use a single assessment method only, and no other unique methods. Even so, some degree of freedom is permitted for calculation of CO_2 emissions related to energy consumption in the occupancy stage (for details, see Section 2.5, "Standard Calculation and Calculation according to the Regional Power Company."

2.3 Assessment Method

(1) Overview

CASBEE for Home (Detached House) includes the following items for assessment among those related to the life cycle of a house:

"Construction":	Production and transportation of members used in the stage of new construction, and construction work itself
"Repair, Renewal, and Demolition":	Production and transportation of members used in the repair stage and transportation of waste materials produced in the demolition stage to disposal facilities
"Occupancy":	Energy and water consumption during occupancy

The life cycle CO_2 of a house is the total of these three categories, and this is used in the evaluation of $LR_H3.1$ and shown as a bar graph in the "global warming impact chart" together with a breakdown. Other stages not contained here, such as extension, remodeling, demolition, and disposal of waste materials, are not evaluated as they are highly individual in nature and cannot be covered by general condition setting. CO_2 emitted from the operation of related facilities such as member production factories or offices or emitted indirectly from the commuting of workers is also excluded from the scope of assessment.

(2) CO_2 emissions in the "Construction" and "Repair, Renewal, and Demolition" stages

As mentioned earlier, since it is difficult to calculate the emissions for each individual house, a general house whose CO_2 emissions have already been calculated (hereinafter referred to as the "standard model house") is used to calculate CO_2 emissions. In other words, the CO_2 emissions of a house for which various measures have been taken is evaluated as the emissions of the standard model house with the same measures taken.

To establish this assessment method, we first calculated the CO_2 emissions of the standard model house in the stages of "Construction" and "Repair, Renewal, and Demolition" (see Section 2.4, "Supplementary Information on Assessment Method"; and Section 3.2, "Reference Materials for Assessment (Reference 4)," for information on the specifications and other details). Since CO_2 emissions can vary greatly depending on the type of construction, calculations were made for three major types of construction: wooden, steel-frame, and reinforced-concrete.* Prior to these calculations, we selected the following four scoring items related to CO_2emissions during the "Construction" and "Repair, Renewal, and Demolition" stages from item Q_H2 and used them as the calculation conditions, as shown in Table 3.5.

* A wooden house is a house of conventional wooden construction; specifically, a house built using the framework method of construction. A steel-frame house is a house of rigid-frame construction using heavy steel. A reinforced-concrete house is a house built using the box-frame-type construction method. The CO_2 emissions for the relevant type of house are calculated. This calculation, however, may end up showing different results if the house being assessed contains other types of construction, such as 2 x 4 construction or light-gauge steel construction. We will consider the addition of data for these other construction methods as required, but for the time being, the users are requested to decide on the most similar method (selected in "$LR_H2.1.1$ Building frames") for the purpose of evaluation.

Table 3.5 Scoring items used to calculate CO_2 emissions in the "Construction" and "Repair, Renewal, and Demolition" stages

Q_H2 Ensuring a Long Service Life	Role in calculating CO_2 emissions
1.1 Building frames	Used to set the building service life
1.2 Exterior wall materials	Used to set the replacement cycle of exterior wall materials
1.3 Roof materials/flat roof	Used to set the replacement cycle of roof materials
2.2 Maintenance system	Used to set the replacement cycle of exterior wall materials and roof materials

Possible scoring items other than the above include effective efforts for CO_2 reduction (such as the following), but these are excluded from the scope of evaluation because it is difficult to set general conditions for them and the data necessary for evaluation, such as the CO_2 emission units, have not yet been established.

Q_H3 category: Promotion of greening and use of local wood products
LR_H2 category: Promotion of 3Rs, efforts in the production and construction stages
LR_H3 category: Reduction of infrastructure loads, efforts in the stage of land development

The assessment results (score level) of the four scoring items and the calculation conditions for CO_2 emissions are correlated as shown in the tables below.

Table 3.6 Correspondence table for scoring results of "Q_H2.1.1 Building frames" and CO_2 calculation conditions

Level	Criterion	CO_2 calculation conditions
Level 1	(No corresponding level)	-
Level 2	(No corresponding level)	-
Level 3	The building satisfies the requirements of Grade 1 in Section 3-1, "Deterioration Resistance Grades (Building Frames, etc.)," of the Japan Housing Performance Indication Standards.	Service life of building frames and foundation: 30 years
Level 4	The building satisfies the requirements of Grade 2 in Section 3-1, "Deterioration Resistance Grades (Building Frames, etc.)," of the Japan Housing Performance Indication Standards.	Service life of building frames and foundation: 60 years
Level 5	The building satisfies the requirements of Grade 3 in Section 3-1, "Deterioration Resistance Grades (Building Frames, etc.)," of the Japan Housing Performance Indication Standards.	Service life of building frames and foundation: 90 years

Table 3.7 Correspondence table for scoring results of "Q_H2.1.2 Exterior wall materials" and "Q_H2.1.3 Roof materials/flat roof" and CO_2 calculation conditions

Level	Criterion	CO_2 calculation conditions
Level 1	A service life of less than 12 years can be expected.	Replacement cycle: 11 years
Level 2	A service life of 12 years to less than 25 years can be expected.	Replacement cycle: 18 years
Level 3	A service life of 25 years to less than 50 years can be expected.	Replacement cycle: 37 years
Level 4	A service life of 50 years to less than 100 years can be expected.	Replacement cycle: 75 years
Level 5	(May be selected if the Conditions for adding points are met.)	Same as Level 4

Table 3.8 Correspondence table for scoring results of "Q_H2.2.2 Maintenance system" and CO_2 calculation conditions

Level	Criterion	CO_2 calculation conditions
Level 1	(No corresponding level)	-
Level 2	(No corresponding level)	-
Level 3	No action taken.	Reduction of the above replacement cycle
Level 4	Corresponds to one of the Efforts to be evaluated.	Maintenance of the above replacement cycle
Level 5	Corresponds to two or more of the Efforts to be evaluated.	Extension of the above replacement cycle

Efforts to be evaluated

No.	Effort
1	A mechanism is incorporated for the implementation of periodic inspections as well as maintenance, repairs, and replacement at the appropriate times.
2	A mechanism is incorporated that provides information, such as manuals or periodicals, or a consultation service to assist the building occupants in continuing appropriate maintenance.
3	Basic information related to the building (such as design documents, construction records, specification member list, etc.) and the maintenance history of the building are maintained and used in follow-up inspections when any anomaly occurs.

The corrections of the replacement cycles in terms of years as per "Q_H2.2.2 Maintenance system" are shown below.

Table 3.9 Correction of service life of exterior wall materials and roof materials as per "Q_H2.2.2 Maintenance system"

		Q_H2.2.2 Maintenance system			Correction in terms of years
		Level 3	Level 4	Level 5	
Q_H2.1.2 Q_H2.1.3	Level 1	11 years	11 years	11 years	None
	Level 2	12 years	18 years	24 years	6 years
	Level 3	25 years	37 years	49 years	12 years
	Level 4	50 years	75 years	100 years	25 years
	Level 5	50 years	75 years	100 years	25 years

Note: For Level 1, the mandatory defect warranty period for the roof and exterior walls is 10 years. Thus, no period of 10 years or less is set, and 11 years is set as the fixed period.

Tables 3.10 through 3.15 amalgamate the calculation results according to the respective conditions. The values in these tables indicate the CO_2 emissions in the "Construction" and "Repair, Renewal, and Demolition" stages, respectively. For example, if a wooden house has a Level 3 rating for all four scoring items, its CO_2 emissions in the "Construction" and "Repair, Renewal, and Demolition" stages are 8.915 and 3.023, respectively, based on Tables 3.10 and 3.11.

Therefore, once the type of construction and the four scoring levels are determined, the corresponding values in these tables can simply be selected, providing a procedure that eliminates any complicated processes in the assessment.

Table 3.10 CO_2 emissions of a wooden house in the "Construction" stage (unit: kg-CO_2/year m^2)

Q_H2.1.1 Building frames		
Level 3	Level 4	Level 5
8.915	4.457	2.972

Table 3.11 CO^2 emissions of a wooden house in the "Repair, Renewal, and Demolition" stage (unit: kg-CO_2/year m^2)

		Q_H2.1.1 Building frames								
		Level 3			Level 4			Level 5		
		Q_H2.2.2 Maintenance system			Q_H2.2.2 Maintenance system			Q_H2.2.2 Maintenance system		
Q_H2.1.2 Exterior wall materials	Q_H2.1.3 Roof materials/flat roof	Level 3	Level 4	Level 5	Level 3	Level 4	Level 5	Level 3	Level 4	Level 5
Level 1	Level 1	5.197	5.197	5.197	7.259	7.259	7.259	8.336	8.336	8.336
	Level 2	5.197	4.662	4.127	7.259	6.722	6.722	8.336	7.799	7.622
	Level 3	4.127	4.127	4.127	6.455	6.455	6.187	7.622	7.266	7.266
	Level 4, 5	4.127	4.127	4.127	6.187	6.187	6.187	7.266	7.087	7.087
Level 2	Level 1	5.197	4.645	4.094	7.259	6.707	6.707	8.336	7.785	7.601
	Level 2	5.197	4.11	3.023	7.259	6.17	6.17	8.336	7.249	6.886
	Level 3	4.127	3.576	3.023	6.455	5.903	5.635	7.622	6.713	6.528
	Level 4, 5	4.127	3.576	3.023	6.187	5.635	5.635	7.266	6.535	6.349
	Level 1	4.094	4.094	4.094	6.431	6.431	6.154	7.601	7.232	7.232

Level 3	Level 2	4.094	3.558	3.023	6.431	5.895	5.62	7.601	6.696	6.518
	Level 3	3.023	3.023	3.023	5.628	5.628	5.084	6.886	6.161	6.161
	Level 4, 5	3.023	3.023	3.023	5.36	5.36	5.084	6.528	5.983	5.983
Level 4, 5	Level 1	4.094	4.094	4.094	6.154	6.154	6.154	7.232	7.048	7.048
	Level 2	4.094	3.558	3.023	6.154	5.62	5.62	7.232	6.513	6.334
	Level 3	3.023	3.023	3.023	5.351	5.351	5.084	6.518	5.977	5.977
	Level 4, 5	3.023	3.023	3.023	5.084	5.084	5.084	6.161	5.799	5.799

* In this table, CO_2 emissions increase as the level of "Q_H2.1.1 Building frames" becomes higher, because a house with a longer service life has a greater incidence of "Renewal" of its interior and exterior elements, equipment, services, and members; in other words, it uses more materials. In many cases, the total emissions including those in the "Construction" stage decrease as the level of "Q_H2.1.1 Building frames" becomes higher, but the opposite may occur if there are an excessive number of replacements of other members during the service life period of the building frames. This phenomenon also applies to houses of other types of construction.

Table 3.12 CO_2 emissions of a steel-frame house in the "Construction" stage (unit: kg-CO_2/year m^2)

Q_H2.1.1 Building frames		
Level 3	Level 4	Level 5
15.051	7.526	5.018

Table 3.13 CO_2 emissions of a steel-frame house in the "Repair, Renewal, and Demolition" stage (unit: kg-CO_2/year m^2)

		Q_H2.1.1 Building frames								
		Level 3			Level 4			Level 5		
		Q_H2.2.2 Maintenance system			Q_H2.2.2 Maintenance system			Q_H2.2.2 Maintenance system		
Q_H2.1.2 Exterior wall materials	Q_H2.1.3 Roof materials/flat roof	Level 3	Level 4	Level 5	Level 3	Level 4	Level 5	Level 3	Level 4	Level 5
Level 1	Level 1	5.133	5.133	5.133	7.489	7.489	7.489	8.678	8.678	8.678
	Level 2	5.133	4.581	4.03	7.489	6.938	6.938	8.678	8.127	7.944
	Level 3	4.03	4.03	4.03	6.662	6.662	6.387	7.944	7.576	7.576
	Level 4, 5	4.03	4.03	4.03	6.387	6.387	6.387	7.576	7.392	7.392
Level 2	Level 1	5.133	4.542	3.952	7.489	6.899	6.899	8.678	8.088	7.892
	Level 2	5.133	3.99	2.847	7.489	6.347	6.347	8.678	7.535	7.155
	Level 3	4.03	3.44	2.847	6.662	6.07	5.796	7.944	6.984	6.788
	Level 4, 5	4.03	3.44	2.847	6.387	5.796	5.796	7.576	6.802	6.604
Level	Level 1	3.952	3.952	3.952	6.603	6.603	6.308	7.892	7.496	7.496
	Level 2	3.952	3.398	2.847	6.603	6.052	5.757	7.892	6.944	6.761

3	Level 3	2.847	2.847	2.847	5.776	5.776	5.205	7.155	6.393	6.393
	Level 4, 5	2.847	2.847	2.847	5.501	5.501	5.205	6.788	6.211	6.211
Level 4, 5	Level 1	3.952	3.952	3.952	6.308	6.308	6.308	7.496	7.299	7.299
	Level 2	3.952	3.398	2.847	6.308	5.757	5.757	7.496	6.747	6.564
	Level 3	2.847	2.847	2.847	5.48	5.48	5.205	6.761	6.197	6.197
	Level 4, 5	2.847	2.847	2.847	5.205	5.205	5.205	6.393	6.013	6.058

Table 3.14 CO_2 emissions of a reinforced-concrete house in the "Construction" stage (unit: kg-CO_2/year m^2)

Q_H2.1.1 Building frames		
Level 3	Level 4	Level 5
16.831	8.415	5.611

Table 3.15 CO_2 emissions of a reinforced-concrete house in the "Repair, Renewal, and Demolition" stage (unit: kg-CO_2/year m^2)

	Q_H2.1.1 Building frames								
	Level 3			Level 4			Level 5		
	Q_H2.2.2 Maintenance system			Q_H2.2.2 Maintenance system			Q_H2.2.2 Maintenance system		
Q_H2.1.3 Roof materials/flat roof	Level 3	Level 4	Level 5	Level 3	Level 4	Level 5	Level 3	Level 4	Level 5
Level 1	3.267	3.267	3.267	5.117	5.117	5.117	5.777	5.777	5.777
Level 2	3.267	3.199	3.132	5.117	5.051	5.051	5.777	5.71	5.686
Level 3	3.132	3.132	3.132	5.016	5.016	4.983	5.686	5.644	5.644
Level 4, 5	3.132	3.132	3.132	4.983	4.983	4.983	5.644	5.622	5.622

(3) CO_2 emissions in the "Occupancy" stage

To begin with, CO_2 emissions related to energy consumption by type of use (heating, cooling, hot water, lighting, home electric appliances, cooking, and ventilation) and water consumption for an ordinary home are set according to the energy saving area classification as shown in Table 3.16 ("Standard values for calculation"). The CO_2 emissions thus calculated for each application are then adjusted depending on the efforts made for the subject building.

When the values are adjusted as above, 13 scoring items selected from LR_H1 that are related to CO_2 emissions in the "Occupancy" stage, as shown in Table 3.17, are used as calculation conditions.

Table 3.16 Standard values for calculation (unit: kg-CO_2/year m^2)

Area classification	Heating	Cooling	Hot-water supply	Lighting	Home electric appliances	Cooking	Ventilation	Water saving
I	12.75	0.00	8.94	3.76	7.57	1.28	1.87	1.33
II	8.66	0.04	10.77	3.76	7.86	1.33	1.95	1.38
III	6.64	0.28	10.84	3.76	8.30	1.41	2.06	1.46
IV	3.61	0.85	10.43	3.76	8.34	1.41	2.06	1.46
V	2.39	0.86	8.26	3.76	8.01	1.36	1.98	1.41
VI	0.00	2.20	6.11	3.76	7.86	1.33	1.95	1.38

Table 3.17 Scoring items used to calculate CO_2 emissions in the "Occupancy" stage

LR_H1 Conserving Energy and Water	Role in calculating CO_2 emissions
1.1 Control of thermal load of building	Used to set the level of energy saving in heating
1.2 Natural energy use	Used to set the level of energy saving in heating and cooling
2.1.1 Heating system	Used to set the level of energy saving in heating

2.1.2 Cooling system	Used to set the level of energy saving in cooling
2.2.1 Hot-water supply equipment	Used to set the level of energy saving in hot-water supply
2.2.2 Heat insulation of bathtub	Used to set the level of energy saving in hot-water supply
2.2.3 Hot-water plumbing	Used to set the level of energy saving in hot-water supply
2.3 Lighting fixtures, home electric appliances, and kitchen equipment	Used to set the level of energy saving in lighting, etc.
2.4 Ventilation system	Used to set the level of energy saving in ventilation
2.5.1 Home cogeneration system	Used to set the level of energy saving in heating and hot-water supply
2.5.2 Solar power generation system	Used to set the level of energy saving in heating; cooling; hot-water supply; lighting, etc.; and ventilation
3.1 Water-saving systems	Used to set the level of water saving
3.2 Rainwater use	Used to set the level of water saving

The calculation of CO_2 emissions for each application is shown below.

① Heating

The consumption rate is calculated from the assessment levels of the three scoring items related to heating use, and the calculated rate is multiplied by the standard value to obtain the CO_2 emissions for heating. When a house has an evaluation of Level 4 or higher for "LR_H1.2.5.1 Home cogeneration system," its CO_2 emissions are calculated on the assumption that the assessment for "LR_H1.2.1.1 Heating system" is Level 5:*

CO_2 emissions for heating = LR_H1.1.1 consumption rate ✕ LR_H1.1.2 consumption rate ✕ LR_H2.1.1 consumption rate x Standard value for heating.

Table 3.18 Relationship between scoring level and consumption rate

	Level 1	Level 2	Level 3	Level 4	Level 5
LR_H1.1.1 Control of thermal load of building	150	125	100	-	69
LR_H1.1.2 Natural energy use	(100 – Heating energy reduction rate)				
LR_H1.2.1.1 Heating system	125	-	100	-	75

* The "Eco Will" home cogeneration system uses gas combustion to generate power and recover heat and is a complete system inside a virtual closed space. To evaluate CO_2 based on the use of "Eco Will," it is necessary to simultaneously consider CO_2 emissions from gas consumption, reduction of CO_2 emissions by the quantity of power generated, and reduction of CO_2 emissions from hot-water supply and heating by waste heat recovery. At the present time, however, sufficient basic data necessary for such evaluation have not yet been released, nor has an assessment method been established. The tentative solution currently adopted is to assess hot-water supply and heating as Level 5 in consideration of the waste heat recovery realized by power generation, so as to calculate the CO_2 emissions.
* For scoring item "LR_H1.1.2 Natural energy use," efforts to reduce energy for either heating or cooling are evaluated for the scoring criteria of Level 3 and 4. For the calculation of CO_2 emissions, however, it has been decided that the reduction effects for heating and cooling should be separately calculated. In line with this decision, the assessment software is now programmed to accept selection and input of the reduction ratios for heating and for cooling independently. However, for the calculation of CO_2 emissions based on the reference value, the energy reduction effect should be prorated for both heating and cooling, and a consumption rate of 95 should be used for the purpose of simplification.

② Cooling

The consumption rate is calculated based on the assessment level of the two scoring items related to cooling use, and the rate is multiplied by the standard value to obtain the CO_2 emissions for cooling:

CO_2 emissions for cooling = LR_H1.1.2 consumption rate ✕ LR_H2.1.2 consumption rate ✕ Standard value for cooling.

Table 3.19 Relationship between scoring level and consumption rate

	Level 1	Level 2	Level 3	Level 4	Level 5
LR_H1.1.2 Natural energy use	(100 – Cooling energy reduction rate)				
LR_H1.2.1.2 Cooling system	125	-	100	-	75

③ Hot-water supply

The consumption rate is calculated based on the assessment level of the three scoring items related to hot-water supply, and the rate is multiplied by the standard value to obtain the CO_2 emissions for hot-water supply. If the assessment for "LR_H1.2.5.1 Home cogeneration system" is Level 4 or more, the assessment for "LR_H1.2.2.1 Hot-water supply equipment" should be regarded as Level 5, and the CO_2 emissions calculated accordingly:

CO_2 emissions for hot-water supply = LR_H1.2.2.1 consumption rate ✕ LR_H1.2.2.2 consumption rate ✕ LR_H1.2.2.3 consumption rate ✕ Standard value for hot water supply.

Table 3.20 Relationship between scoring level and consumption rate

	Level 1	Level 2	Level 3	Level 4	Level 5
LR_H1.2.2.1 Hot-water supply equipment	117	-	100	83	71
LR_H1.2.2.2 Heat insulation of bathtub	105	-	100	-	95
LR_H1.2.2.3 Hot-water plumbing	-	111	100	94	89

④ Lighting fixtures, home electric appliances, and kitchen equipment

The consumption rate is calculated based on the assessment level of the one scoring item related to lighting fixtures, home electric appliances, and kitchen equipment, and the rate is multiplied by the standard value to obtain the CO_2 emissions for this item:

CO_2 emissions for lighting fixtures, home electric appliances, and kitchen equipment = LR_H1.2.3 consumption rate ✕ (Standard value for lighting fixtures + Standard value for home electric appliances + Standard value for kitchen equipment).

Table 3.21 Relationship between scoring level and consumption rate

	Level 1	Level 2	Level 3	Level 4	Level 5
LR_H1.2.3 Lighting fixtures, home electric appliances, and kitchen equipmen	125	-	100	88	75

⑤ Ventilation

The consumption rate is calculated based on the assessment level of the one scoring item related to ventilation, and the rate is multiplied by the standard value to obtain the CO_2 emissions for ventilation:

CO_2 emissions for ventilation = LR_H1.2.4 consumption rate ✕ Standard value for ventilation.

Table 3.22 Relationship between scoring level and consumption rate

	Level 1	Level 2	Level 3	Level 4	Level 5
LR_H1.2.4 Ventilation system	-	-	100	70	40

⑥ Water consumption

The consumption rate is calculated based on the assessment level of the two scoring items related to water consumption, and the rate is multiplied by the standard value to obtain the CO_2 emission for water consumption:

CO_2 emissions for water consumption = LR_H1.3.1 consumption rate ✕ LR_H1.3.2 consumption rate ✕ Standard value for water consumption.

Table 3.23 Relationship between scoring level and consumption rate

	Level 1	Level 2	Level 3	Level 4	Level 5
LR_H1.3.1 Water-saving systems	115	-	100	85	70
LR_H1.3.2 Rainwater use	-	-	100	99	90

⑦ Solar power generation system

The reduction of CO_2 emissions by solar power generation is calculated by multiplying the total value of CO_2 emissions calculated from ① to ⑤ above by the energy-saving ratio k calculated in "LR_H1.2.5.2 Solar power generation system":

CO_2 emissions reduction by solar power generation = Total value of CO_2 emissions calculated from ① to ⑤ ✕ Energy-saving ratio k.

As described above, the CO_2 emissions in the "Occupancy" stage are then calculated by the following equation:

CO_2 emissions during "Occupancy" stage = (CO_2 emissions for heating + CO_2 emissions for cooling + CO_2 emissions for hot-water supply + CO_2 emissions for lighting fixtures, home electric appliances, and kitchen equipment + CO_2 emissions for ventilation) x (1 - k) + CO_2 emissions for water consumption.

However, if k ≧ 1, the following equation should be used:

CO_2 emissions during "Occupancy" stage = CO_2 emissions for water consumption.

(4) Conversion from life cycle CO_2 emission to score of LR_H3.1

The sum of the CO_2 emissions in the stages of "Construction" and "Repair, Renewal, and Demolition" as calculated in (2) and the CO_2 emissions during the "Occupancy" stage as calculated in (3) is the life cycle CO_2emission for the subject building. The results derived based on the assumption that the evaluation for all of the 17 scoring items shown in Table 3.5 and 3.17 is Level 3 is the life cycle CO_2 emission for an ordinary house ("reference value").

Evaluation for LR_H3.1 "Consideration of Global Warming" is performed based on the ratio of the above reference value to the emissions from the subject building ("emission rate"). If the emission rate is 100%, as shown in Table 3.24, the result is Level 3. If it is not more than 75%, it is Level 5. If it is 125% or more, it is Level 1. This result is translated into the following equations:

Emission rate = Emissions from subject building / Reference value.

LR_H3.1 level = - 0.08 x Emission rate + 11.

3

Table 3.24 Assessment level for LR_H3.1 Consideration of Global Warming

Level	Criterion
Level 1 to Level 5	Levels are expressed in life cycle CO_2 emission rates converted to any of the numbers 1 through 5 (down to the first decimal place). Levels 1, 3, and 5 are defined by the following emission rates: Level 1: The life cycle CO_2 emission rate is 125% or higher than that of an ordinary house (reference value). Level 3: The life cycle CO_2 emission rate is equal to that of an ordinary house (reference value). Level 5: The life cycle CO_2 emission rate is 75% or lower than that of an ordinary house (reference value).

The level for LR_H3.1 becomes the score SLR_H3.1.

(5) "CO_2 calculation" and "CO_2 data" sheets of the assessment software

The above calculation process is shown in the "CO_2 calculation" sheet of the assessment software. The sheet is divided into two parts: "Life Cycle CO_2 Calculation Sheet (for Standard Calculation)" and "Life Cycle CO_2 Calculation Sheet (for Calculation according to the Regional Power Company)." The following explains the "Life Cycle CO_2 Calculation Sheet (for Standard Calculation)."

1. CO_2 Emissions Related to Construction

Figure 3.7 shows an example of a display. The scoring items related to "Construction" are shown on the left of the figure, a list of CO_2 emissions corresponding to each level is shown at the center, and a table of the "Score" and "CO_2 emission" for each "Subject" and "Reference" is shown on the right. The list of CO_2 emissions is automatically extracted from the database of the "CO_2 data" sheet according to the level of each scoring item in the "Subject" column.

In this example, the assessment for "Q_H2.1.1 Building frames" is Level 5 in the category of wooden building (the cells in the "Ratio of material type" column are automatically filled by the values input in "Q_H2.1.1 Building frames" in the "LR2 scoring" sheet; this example is for a single wooden structure), those for "Q_H2.1.2 Exterior wall materials" and "Q_H2.1.3 Roofing materials/flat roof" are both Level 4, and that for "Q_H2.2.2 Maintenance system" is Level 5. The value of CO_2 emissions in the "Subject" column that corresponds to this combination is 2.97 kg-CO_2 /year m². On the other hand, Level 3 is the only assessment result in the "Reference" column. Hence, the CO_2 emissions from the wooden house come to 8.92 kg-CO_2/year m².

1. CO_2 Emissions Related to Construction

1-1. Conversion of Assessment Results to CO_2 Emissions

Q_H2 Ensuring a Long Service Life	Ratio of material type	Level 3 (kg-CO_2/year m²)	Level 4	Level 5	Subject of assessment: Score	Subject of assessment: CO_2 emission (kg-CO_2/year m²)	Reference value: Score	Reference value: CO_2 emission (kg-CO_2/year m²)
1 Basic Life Performance								
1.1 Buildi — Wooden	1	8.92	4.46	2.97	5.0	2.97	3.0	8.92
Steel-frame	0	8.92	4.46	2.97	5.0	2.97	3.0	15.05
Concrete	0	8.92	4.46	2.97	5.0	2.97	3.0	16.83
1.2 Exterior wall materials					4.0		3.0	
1.3 Roof materials/flat roof					4.0		3.0	
2 Maintenance								
2.2 Maintenance system					5.0		3.0	
1-2. Calculation of Totals						2.97		8.92

Fig. 3.7 Example of display of "CO_2 Emissions Related to Construction" in the "CO_2 calculation" sheet

2. CO_2 Emissions Related to Repair, Renewal, and Demolition

The composition of this display is the same as that for "Construction." The results are Level 5 for a wooden house in "Q_H2.1.1 Building frames," Level 4 for both "Q_H2.1.2 Exterior wall materials" and "Q_H2.1.3 Roofing materials/flat roof," and Level 5 for "Q_H2.2.2 Maintenance system." The CO_2 emissions value corresponding to this combination of results is retrieved from the database. In this example, the CO_2 emissions for "Subject of assessment" and "Reference value" are 5.80 kg-CO_2/year m² and 3.02 kg/-CO_2/year m², respectively.

2. CO_2 Emissions Related to Repair, Renewal, and Demolition

2-1. Conversion of Assessment Results to CO2 Emissions

Q_H2 Ensuring a Long Service Life	Ratio of material type	Level 3 (kg-CO_2/year m²)	Level 4	Level 5	Subject of assessment: Score	Subject of assessment: CO_2 emission (kg-CO_2/year m²)	Reference value: Score	Reference value: CO_2 emission (kg-CO_2/year m²)
1 Basic Life Performance								
1.1 Buildi — Wooden	1	3.02	5.08	5.80	5.0	5.80	3.0	3.02
Steel-frame	0	2.85	5.21	6.06	5.0	6.06	3.0	2.85
Concrete	0	3.13	4.98	5.62	5.0	5.62	3.0	3.13
2-2. Calculation of Totals						5.80		3.02

Fig. 3.8 Example of display of "CO_2 Emissions Related to Repair, Renewal, and Demolition" in the "CO_2 calculation" sheet

3. CO_2 Emissions Related to Energy during Occupancy

An example of a display for this category of CO_2 emissions is shown in Fig. 3.9. In "3-1. Conversion of Assessment Results to Consumption Rates," the assessed levels for the related scoring items are shown as the results converted to the consumption rates. Then, in "3-2. Conversion to Consumption Rates and Calculation of CO_2 Emissions for each application," the calculation results for the consumption rates and CO_2 emissions by type of application are shown. Lastly, in "3-3. Calculation of Totals," all of the CO_2 emissions for all uses are totaled, and the results with the solar power generation portion duly adjusted are shown as the CO_2 emissions related to energy during the stage of Occupancy.

4. Calculation of Life Cycle CO_2

The CO_2 emissions calculated for "Construction," "Repair, Renewal, and Demolition," and "Occupancy" are totaled for each "Subject " and "Reference" and the results are shown as the life cycle CO_2. The results displayed in this column are used for evaluation of "LR_H3.1 Consideration of Global Warming," and the corresponding "global warming impact chart" is created in the "Results" sheet.

3. CO_2 Emissions Related to Energy during Occupancy

3-1. Conversion of Assessment Results to Consumption Rates

LR_H Environmental Load Reduction Capability of Building

LR_H1 Conserving Energy and Water	Level 1	Level 2	Level 3	Level 4	Level 5	Subject of assessment: Score	Subject of assessment: Consumption rate	Reference value: Score	Reference value: Consumption rate
1 Energy Saving through Building Innovation									
1.1 Control of thermal load of building	120%	100%	80%	-	55%	3.0	80%	3.0	80%
1.2 Natural energy use								3.0	95%
Reduction of energy for heating						10%	90%		
Reduction of energy for cooling						0%	100%		
2 Energy Saving through Equipment Performance									
2.1 Air-conditioning systems									
1 Heating system	100%	-	80%	-	60%	3.0	80%	3.0	80%
2 Cooling system	100%	-	80%	-	60%	3.0	80%	3.0	80%
2.2 Hot-water equipment									
1 Hot-water supply equipment	-	140%	120%	100%	85%	3.0	120%	3.0	120%
2 Heat insulation of bathtub	100%	-	95%	-	90%	3.0	95%	3.0	95%
3 Hot-water plumbing	-	100%	90%	85%	80%	4.0	85%	3.0	90%
2.3 Lighting fixtures, home electric appliances, and kitchen equipment	100%	-	80%	70%	60%	4.0	70%	3.0	80%
2.4 Ventilation system	-	-	100%	70%	40%	3.0	100%	3.0	100%
2.5 Highly energy-efficient equipment									
2 Solar power generation system						0.1		0.0	
3 Water Saving									
3.1 Water-saving systems	115%	-	100%	85%	70%	4.0	85%	3.0	100%
3.2 Rainwater use	-	-	100%	95%	90%	3.0	100%	3.0	100%

3-2. Conversion to Consumption Rates and Calculation of CO_2 for each applicatio

Use	Equation	Standard (kg-CO_2/year m^2)	Subject: Consumption r	Subject: Converted to CO_2 (kg-CO_2/year m^2)	Reference: Consumption ra	Reference: Converted to CO_2 (kg-CO_2/year m^2)
Heating	Thermal load reduction of building x Use of natural energy x Heating system	5.63	58%	3.24	61%	3.42
Cooling	Use of natural energy x Cooling system	1.06	80%	0.85	76%	0.81
Hot-water supply	Hot-water supply equipment x Heat insulation of bathtub x Hot-water plumbing	9.87	97%	9.57	103%	10.13
Lighting	Lighting fixtures, home electric appliances, and kitchen equipment	4.71	70%	3.29	80%	3.76
Home electric appliances	Lighting fixtures, home electric appliances, and kitchen equipment	10.42	70%	7.30	80%	8.34
Cooking	Lighting fixtures, home electric appliances, and kitchen equipment	1.77	70%	1.24	80%	1.41
Ventilation	Ventilation system	2.06	100%	2.06	100%	2.06
Water saving	Water-saving equipment x Rainwater use	1.46	85%	1.25	100%	1.46

3-3. Calculation of Totals

		Subject (kg-CO_2/year m^2)	Reference (kg-CO_2/year m^2)
Total (Σ(Standard value for each use x Reduction rate for each use))	36.99	28.80	31.41
Reduction with solar power generation system (Total of standard values x Reduction rate)		3.70	0.00
Grand total (Total - Solar power generation)		25.10	31.41

4. Calculation of Life Cycle CO2 (Standard Calculation)

	Subject (kg-CO_2/year m^2)	Reference (kg-CO_2/year m^2)
Construction	2.97	8.92
Repair, renewal, demolition	5.80	3.02
During occupancy	25.10	31.41
Total	33.87	43.34

Fig. 3.9 Example of display of "CO_2 Emissions Related to Energy during Occupancy" and "Calculation of Life Cycle CO_2" in the "CO2 calculation" sheet

3

2.4 Supplementary Information on Assessment Method

(1) Calculation conditions for "Construction" and "Repair, Renewal, and Demolition"

This section describes the standard model house and the calculation conditions used for CO_2 emission calculation for "Construction" and "Repair, Renewal, and Demolition."

① Calculation method for "Construction"

The plan for the standard model house is taken from the standard model for tests of the Architectural Institute of Japan (AIJ). A plan view of this model is shown in Fig. 3.10. Based on this plan, the specifications generally used for a wooden house (conventional wooden building), a steel-frame house (heavy steel frame), and a reinforced-concrete house (box-frame-type construction method) were assumed, and the members necessary to satisfy these assumed specifications were identified. See Section 3.2, "Reference Materials for Assessment (Reference 4)," below for the detailed drawings and specifications.

The weights of all the constituent members were determined, and their CO_2 emissions were calculated according to the CO_2 emission units (up to domestic consumption expenditure) published by AIJ based on the 1995 industrial Input-Output Table. All of these values were integrated, and the CO_2 emissions during the "Construction" stage were added to these integrated values using the construction portion scale factors based on the 1995 industrial Input-Output Table for Construction Sector Analysis published by AIJ. The total was converted to the values by year and floor area to obtain the CO_2 emissions during the "Construction" stage.*

* CASBEE for Home (Detached House) uses as the unit of CO_2 the emissions by the year floor area (kg-CO_2/year m^2), not the total of life cycle CO_2 emissions. The reason why the floor area was selected as a

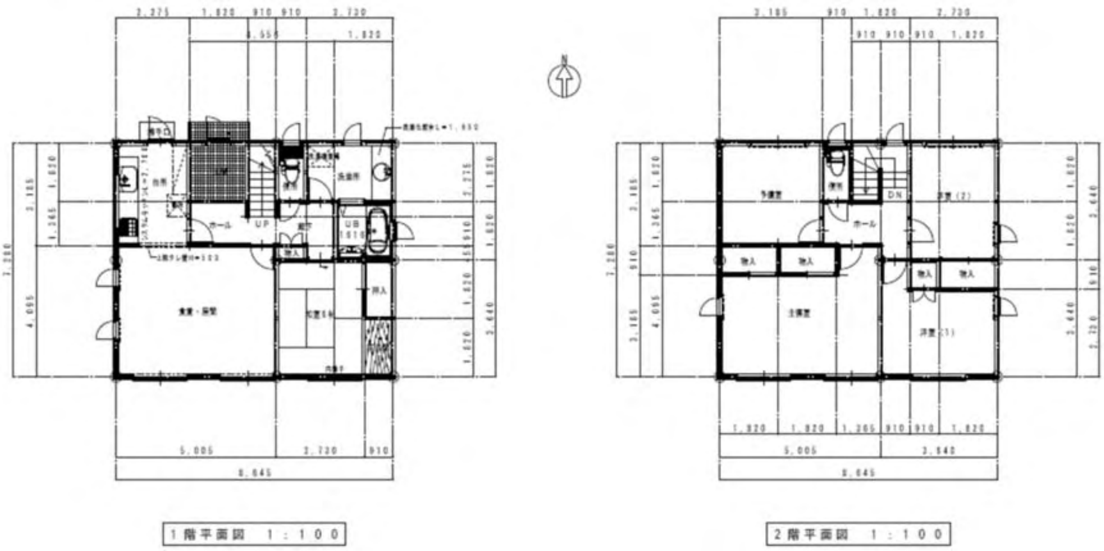


Fig. 3.10 Plan view of the standard model house

unit is that the calculation was conducted using the model house, which has a different floor area from the house to be assessed. We tried to eliminate any negative effects of the scale as much as possible by converting to the value by the floor area. The reason why the year was selected as a unit is that we needed to avoid a situation where, when buildings of different service life are compared, a house with a longer service life will have a greater frequency of member replacement and will eventually have a larger volume of CO_2 emissions if the unit is the total of life cycle CO_2 emissions (30 years of service life is the basis for reference value calculation).

② Calculation method for "Repair"

The repair rate for almost all members was set at 1% per year. In other words, 1% of the CO_2 emissions related to the production of members is counted every year as emissions related to "Repair." The value of the CO_2 emissions during the production stage multiplied by the repair rate was calculated for each member, and by integrating the values of all the members and converting them into the value per floor area, the value of CO_2 emissions during the "Repair" stage was obtained.

③ Calculation method for "Renewal"

The service life was set for every member (the service life of exterior wall materials and roof materials is the length of years corresponding to the score level of Q_H2; that of exterior materials, interior sheathings, and facilities is roughly 30 years; and that of interior finish materials is roughly 15 years). The replacement cycle for each member was then determined based on a building service life of 30 years, 60 years, and 90 years. Using these values, the CO_2 emissions for all members replaced during each building service life are calculated for integration and conversion to the value per year and floor area. The resultant value is the amount of CO_2 emissions during the "Renewal" stage.

④ Calculation method for "Demolition"

The CO_2 emissions resulting from fuel consumption based on the assumption that all constituent members become demolished materials and are transported on 4-ton trucks to a disposal plant 30 km away are calculated, and the converted value by the year and floor area is the amount of CO_2 emissions in the "Demolition" stage.

(2) Calculation conditions for "Occupancy"

CO_2 emissions for the "Occupancy" stage were calculated in basically the same way as in the "Design Guidelines for Self-Cycling Residences" (IBEC) (hereinafter referred to as the "Independence Guidelines"). The Independence Guidelines specify CO_2 emissions from a standard house by the type of use in each region, and the values in the Guidelines were set as the regional values in the "Standard values for calculation" shown in Table 3.16. Other than the region, the values were determined by correcting the earlier mentioned regional CO_2 emissions in accordance with the ratios of the energy consumption of detached houses by region and type of application in the Primary Energy Consumption Calculation Conditions (2006) in Housing and Building High-Efficiency Energy System Introduction Promotion Projects published by NEDO (refer to Table 2.6, "$LR_H1.2.5.2$

Solar power generation system," in Part II, Section 3.3, "Rating Criteria")*[1]. The data for water consumption not shown in the Guidelines were taken from the data of the Waterworks Bureau, Tokyo Metropolitan Government.

Replacement with the consumption rate for each scoring level shown in Tables 3.18 to 3.23 was basically conducted in accordance with the Guidelines. However, it should be noted that there is not complete consistency between the levels indicated by the scoring criteria of CASBEE for Home (Detached House) and the effort levels shown in the Guidelines as they do not necessarily agree with each other. In such cases, and for water consumption data not shown in the Guidelines, we set the consumption rates ourselves based on past research reports and other relevant data.

Note that the CO_2 emissions for "Occupancy" differ from the data published by AIJ used for the "Construction" and "Repair, Renewal, and Demolition" CO_2 emission calculations, and therefore calculation using the value of 0.555 kg-CO_2/kWh shown in the Enforcement Order for the Act Concerning the Promotion of Measures to Cope with Global Warming should be used as the basic data*[2].

*1 The CO_2 emissions shown in the Guidelines are the results of a case study of an all-electric house. The values used for regional correction are for primary energy consumption, which contain statistical data not only for electricity but also gas and kerosene. Since such data have not been fully established at the present time, we carried out tentative corrections based on the said method. This needs to be reviewed in the future.

*2 Calculations of the CO_2 emissions in the Guidelines used the electricity emission coefficient, 0.378 kg-CO_2/kWh, as shown in the former Enforcement Order for the Act Concerning the Promotion of Measures to Cope with Global Warming. Table 3.16 shows that value converted to 0.555 kg-CO_2/kWh.

(Reference) Sensitivity of Life Cycle CO_2 in Each Scoring Item Used in the Calculations for "Occupancy"

Figure 3.11 shows the sensitivity by the level of the related scoring items with respect to the CO_2 emissions in the "Occupancy" stage according to the above calculation conditions. The percentages shown in the figure are the ratio of the difference in emissions from that in Level 3 (reference value) to the total life cycle CO_2 emissions.

Application	Scoring item	Level 1	Level 2	Level 3	Level 4	Level 5
Heating	LR_H1.1.1 Control of thermal load of building	3.7%	1.9%	0.0%	-	-2.3%
	LR_H1.1.2 Natural energy use	0.8%	-	0.0%	-0.8%	-0.8%
	LR_H1.2.1.1 Heating system	1.9%	-	0.0%	-	-1.9%
	Total sensitivity	8.1%	←		→	-4.1%
Cooling	LR_H1.1.2 Natural energy use	0.2%	-	0.0%	-0.2%	-0.2%
	LR_H1.2.1.2 Cooling system	0.4%	-	0.0%	-	-0.4%
	Total sensitivity	0.7%	←		→	-0.6%
Ventilation Hot-water supply	LR_H1.2.4 Ventilation system	-	-	0.0%	-1.4%	-2.9%
	LR_H1.2.2.1 Hot-water supply equipment	-	3.9%	0.0%	-3.9%	-6.8%
	LR_H1.2.2.2 Heat insulation of bathtub	1.2%	-	0.0%	-	-1.2%
	LR_H1.2.2.3 Hot-water plumbing	-	2.6%	0.0%	-1.3%	-2.6%
	Total sensitivity	8.5%	←		→	-9.4%
Lighting fixtures, home electric appliances, and kitchen equipment	LR_H1.2.3 Lighting fixtures, home electric appliances, and kitchen equipment	7.8%	-	0.0%	-3.9%	-7.8%

Cogeneration	LR_H2.5.1 Home cogeneration system	-	-	0.0%	-8.7%	-8.7%

*Independent sensitivity assuming that other items related to heating and hot-water supply use are rated as Level 3

Water	LR_H1.3.1 Water-saving systems	0.5%	-	0.0%	-8.7%	-1.0%
	LR_H1.3.2 Rainwater use	-	-	0.0%	0.0%	-0.3%
	Total sensitivity	-	-	0.0%	-0.5%	-1.2%

Fig. 3.11 Sensitivity of emission ratios relative to life cycle CO_2 (example for a wooden house)

2.5 Standard Calculation and Calculation according to the Regional Power Company

The above explanation represents the "Standard Calculation" method in CASBEE for Home (Detached House). "Standard Calculation" is the only method used for the assessment of LR_H3.1 and calculation of BEE_H. The other method of calculation employed is "Calculation according to the Regional Power Company," which is used to convert the electricity emission coefficient for "Occupancy" to a value other than 0.555 kg-CO_2/kWh.

Since, in life cycle CO_2 for homes, the share of CO_2 emissions from "Occupancy" is much greater than that from "Construction" or "Repair, Renewal, and Demolition," the emission coefficient for electricity used in the calculations for the "Occupancy" stage is very influential. The value used for the "Standard Calculation," 0.555 kg-CO_2/kWh, which is the value "in a case where the emission coefficient of electricity being used is unknown," is one of the "emission coefficients of electricity" described in the section detailing methods of calculating greenhouse gas emissions associated with the use of electricity (Article 21, Paragraph 2-2) of the Enforcement Order for the Act Concerning the Promotion of the Measures to Cope with Global Warming, and is different from any of the electricity emission coefficients used by the regional power companies. Some power companies have published values that are significantly smaller than this value, and there is a nonnegligible error in the absolute quantity of CO_2 emissions.

We have therefore made available an optional calculation method, "Calculation according to the Regional Power Company," for users who wish to know the CO_2 emissions based on the published values of regional power companies and can perform the calculation using a different electricity emission coefficient. The key to this method of calculation is correction of the emissions other than the value for "Water consumption" in the following equation shown in Section 2.3 (3), ‘CO_2 emissions in the "Occupancy" stage':

CO_2 emissions in "Occupancy" stage = (CO_2 emissions for heating + CO_2 emissions for cooling + CO_2 emissions for hot-water supply + CO_2 emissions for lighting fixtures, home electric appliances, and kitchen equipment + CO_2 emissions for ventilation) ✕ (1 - k) ✕ (Electricity emission coefficient used / 0.555) + CO_2 emissions for water consumption.

The assessment software allows the user to select the desired CO_2 emission coefficient for electricity in the "CO_2 calculation" sheet. If the user selects a value other than "Standard" (0.555 kg-CO_2/kWh), the results using "Calculation according to the Regional Power Company") are shown in the "global warming impact chart" in the "Results" sheet. To allow immediate recognition that the method of "Calculation according to the Regional Power Company" has been selected, the software is designed to change the background color of the chart and show "* Calculation according to the Regional Power Company" above the chart.

As explained earlier, even in this case, the "Standard Calculation" will be used for LR_H3.1 and BEE_H.

Life Cycle CO2 Calculation Sheet (for Calculation according to the Regional Power Company)

Selection of emission coefficient (power)※

Standard

※Notes
- The emission coefficient selected here is used to calculate the CO2 emissions related to energy during occupancy.
- The result in this cell is shown in Section 2-3, "Life Cycle CO2 (global warming effect chart)," in the "Results" sheet, but is not used for BEE calculation.
- See the Manual for details.

kg-CO_2/kWh

Power company	Emission coefficient
Standard	0.555
Hokkaido Electric Power	0.502
Tohoku Electric Power	0.510
Tokyo Electric Power	0.368
Chubu Electric Power	0.452
Hokuriku Electric Power	0.407
Kansai Electric Power	0.358
Shikoku Electric Power	0.378
Kyushu Electric Power	0.365
Other power suppliers	

Remarks

The values in the table at left are "emission coefficients of electricity" described in the method for calculation of greenhouse gas emissions generated by use of electricity under the Enforcement Order for the Act Concerning the Promotion of Measures to Cope with Global Warming (Article 21-2, Paragraph 2). "Standard" refers to the value "in a case where the emission coefficient of electricity being used is unknown," and the emission coefficient of each power company is the value publicly announced in April 2007 based on the applicable ordinances of the Ministry of the Environment and the Ministry of Economy, Trade and Industry.

5. Calculation of Life Cycle CO2 (for Calculation according to the Regional Power Company)

	Subject (kg-CO_2/year m^2)	Reference (kg-CO_2/year m^2)
Construction	2.97	8.92
Repair, renewal, demolition	5.80	3.02
During occupancy	25.10	31.41
Total	**33.87**	**43.34**

Fig. 3.12 "CO_2 calculation" sheet of the assessment software (for "Calculation according to the Regional Power Company")

2.6 Important Points to Note

As mentioned earlier, from the viewpoint of ease of use, which is the basic principle for the entire CASBEE Family, the calculation is actually based on a fairly simplified technique. Therefore, the result should not be taken to guarantee a high level of precision. In particular, this should be fully understood when referring to the "global warming impact chart" in the software, which indicates the absolute quantities of CO_2 emissions. However, we believe that it is necessary to present data on CO_2 emissions from houses to the general public, irrespective of how approximate these data may be, in consideration of the present situation where such CO_2 emissions or CO_2reduction effects, even in terms of rough figures, are rarely known by not only the general public but housing suppliers as well.

As regards the emission coefficient of electricity when reduction effects by various measures are being evaluated, another approach that evaluates by "power sources expected to be influenced" ("Manual for Calculation and Reporting of Greenhouse Effect Gas Emissions" by the Ministry of the Environment and the Ministry of Economy, Trade and Industry, June 2007) may be used instead of the above approach. Therefore, as one of the issues to be solved for the entire CASBEE Series, we intend to continue reviewing how to handle the electricity emission coefficient for the evaluation of reduction effects.

3 Reference Information

3.1 List of Reference Information

The following is a list of literature, laws, and other documents used, referenced, or mentioned in the rating criteria.

Information	Publisher, etc.	Relevant assessment items
Japan Housing Performance Indication Standards	The Housing Quality Assurance Act	Q_H1.1.1.1 Ensuring thermal insulation and airtightness performance Q_H1.2.1.1 Countermeasures against chemical contaminants Q_H1.2.3.1 Precautions against crime Q_H1.3.1.1 Use of daylight Q_H1.4.2.1 Quietness Q_H2.1.1.1 Building frames Q_H2.1.4.1 Resistance against natural disasters Q_H2.1.5.1 Fire-resistant structure (excluding openings) Q_H2.1.5.2 Early detection of fire Q_H2.2.1.3 Ease of maintenance Q_H2.3.2.3 Barrier-free design LR_H1.1.1.3 Control of thermal load of building
Guide to Energy-saving Standards for Houses	Institute for Building Environment and Energy Conservation (IBEC)	Q_H1.1.1.1 Ensuring thermal insulation and airtightness performance Q_H1.1.1.2 Sunlight adjustment capability LR_H1.1.1.3 Control of thermal load of building
Design Guidelines for Self-Cycling Residences	Institute for Building Environment and Energy Conservation (IBEC)	Q_H1.1.1.2 Sunlight adjustment capability Q_H1.1.2.1 Allowing breezes in and heat out LR_H1.1.2.3 Natural energy use LR_H3.1 Consideration of Global Warming
Century Housing System accreditation criteria	The Center for Better Living	Q_H2.1.2.1 Exterior wall materials Q_H2.1.3.1 Roof materials/flat roof
Manual for Building Life Cycle Energy Calculation Program	Building Research Institute	Q_H2.1.2.1 Exterior wall materials Q_H2.1.3.1 Roof materials/flat roof
Interior Wiring Codes 3605-1 and 3545-2	Japan Electric Association	Q_H2.2.1.3 Ease of maintenance
Guidelines for Greening Plans	Tokyo Metropolitan Government	Q_H3.2.1.3 Greening of the premises
Guidelines for Greening of Places of Business	Hiratsuka City, Kanagawa Prefecture	Q_H3.2.1.3 Greening of the premises
Environmentally Symbiotic Housing Certification Criteria	Institute for Building Environment and Energy Conservation (IBEC)	LR_H1.3.1.3 Water-saving systems LR_H1.3.2.3 Rainwater use
Recommendations on Handling of Greening Plants for Preservation of Biodiversity	The Japanese Society of Revegetation Technology	LR_H3.2.2.3 Preservation of the existing natural environment

3.2 Reference Materials for Assessment

The following are some of the reference materials used in the rating criteria.

	Name of reference material	Page
Reference 1	Appendix 1 of the “Judgment Criteria for Building Owners for Energy Efficiency Standards”	P184
Reference 2	Appendix 2 of the “Judgment Criteria for Building Owners for Energy Efficiency Standards”	P186
Reference 3	Extract from the “Basic Policy for the Promotion of Procurement of Eco-Friendly Goods and Services” (determined by the Cabinet after partial revision on February 2, 2007)	P188
Reference 4	“Standard Model House” for Life Cycle CO_2 Assessment	P195

(Reference 1) Appendix 1 of the "Judgment Criteria for Building Owners for Energy Efficiency Standards"

Appendix 1

Area classification	Prefectures
I	Hokkaido
II	Aomori, Iwate, Akita
III	Miyagi, Yamagata, Fukushima, Tochigi, Niigata, Nagano
IV	Ibaraki, Gunma, Saitama, Chiba, Tokyo, Kanagawa, Toyama, Ishikawa, Fukui, Yamanashi, Gifu, Shizuoka, Aichi, Mie, Shiga, Kyoto, Osaka, Hyogo, Nara, Wakayama, Tottori, Shimane, Okayama, Hiroshima, Yamaguchi, Tokushima, Kagawa, Ehime, Kochi, Fukuoka, Saga, Nagasaki, Kumamoto, Oita
V	Miyazaki, Kagoshima
VI	Okinawa

1. The following municipalities should be classified as Area I regardless of the above classification:

Aomori	Towada City (limited to former Towada-ko Town), Shichinohe Town (limited to former Shichinohe Town), Takko Town
Iwate	Kuji City (limited to former Yamagata Village), Hachimantai City, Kazumaki Town, Iwate Town, Nishiwaga Town

2. The following municipalities should be classified as Area II regardless of the above classification:

Hokkaido	Hakodate City (limited to former Hakodate City), Matsumae Town, Fukushima Town, Shiriuchi Town, Kikonai Town, Yakumo Town (limited to former Kumaishi Town), Esashi Town, Kaminokuni Town, Assabu Town, Otobe Town, Setana Town (excluding former Setana Town), Shimamaki Village, Suttu Town
Miyagi	Kurihara City (limited to former Kurikoma Town, former Ichihasama Town, former Uguisuzawa Town, and former Hanayama Town)
Yamagata	Yonezawa City, Tsuruoka City (limited to former Asahi Village), Shinjo City, Sagae City, Nagai City, Obanazawa City, Nanyo City, Kahoku Town, Nishikawa Town, Asahi Town, Oe Town, Oishida Town, Kaneyama Town, Mogami Town, Funagata Town, Mamurogawa Town, Ohkura Village, Sakegawa Village, Tozawa Village, Takahata Town, Kawanishi Town, Oguni Town, Shirataka Town, Iide Town
Fukushima	Aizuwakamatsu City (limited to former Kawahigashi Town), Shirakawa City (limited to former Taishin Village), Sukagawa City (limited to former Naganuma Town), Kitakata City (excluding former Shiokawa Town), Tamura City (excluding former Miyakoji Village), Otama Village, Ten-ei Village, Shimogo Town, Hinoemata Village, Tadami Town, Minamiaizu Town, Kitashiobara Village, Nishiaizu Town, Bandai Town, Inawashiro Town, Mishima Town, Kaneyama Town, Showa Village, Yabuki Town, Hirata Village, Ono Town, Kawauchi Village, Iitate Village
Tochigi	Nikko City (excluding former Imaichi City), Nasushiobara City (limited to former Shiobara Town)
Gunma	Numata City (excluding former Numata City), Naganohara Town, Tsumagoi Village, Kusatsu Town, Kuni Village, Katashina Village, Kawaba Village, Minakami Town (limited to former Minakami Town)
Niigata	Tokamachi City (limited to former Nakasato Village), Uonuma City (limited to former Irihirose Village), Tsunan Village
Yamanashi	Fujiyoshida City, Hokuto City (limited to former Kobuchisawa Town), Nishikatsura Town, Oshino Village, Yamanakako Village, Fujikawaguchiko Town (limited to former Kawaguchiko Town)
Nagano	Nagano City (excluding former Nagano City and former Ooka Village), Matsumoto City (excluding former Matsumoto City and former Shiga Village), Ueda City (limited to former Sanada Town and former Takeshi Village), Suzaka City, Komoro City, Ina City (excluding former Hase Village), Komagane City, (limited to former Nakano City), Omachi City, Iiyama City, Chino City, Shiojiri City, Saku City, Chikuma City (limited to former Koshoku City), Tomi City, Koumi Town, Kawakami Village, Minamimaki Village, Minamiaiki Village, Kitaaiki Village, Sakuho Town, Karuizawa Town, Miyota Town, Tateshina Town, Nagawa Town, Fujimi Town, Hara Village, Tatsuno Town, Minowa Town, Minamiminowa Village, Miyada Village, Achi Village (limited to former Namiai Village), Hiraya Village, Shimojo Village, Agematsu Town, Kiso Village, Kiso Town, Hata Town, Yamagata Village, Asahi Village, Ikeda Town, Matsukawa Village, Hakuba Village, Otari Village, Obuse Town, Takayama Village, Yamanouchi Town, Kishimadaira Village, Nozawaonsen Village, Shinano Town, Iizuna Town
Gifu	Takayama City, Hida City (limited to former Fukukawa Town and former Kawai Village), Shirakawa Village

3. The following municipalities should be classified as Area III regardless of the above classification:

Aomori	Aomori City (limited to former Aomori City), Fukaura Town
Iwate	Miyako City (excluding former Niisato Village), Ofunato City, Ichinoseki City (limited to former Ichinoseki City, former Hanaizumi Town, and former Daito Town), Rikuzentakata City, Kamaishi City, Hiraizumi Town
Akita	Akita City (excluding former Kawabe Town), Noshiro City (limited to former Noshiro City), Oga City, Yurihonjo City (excluding former Higashiyuri Town), Katagami City, Nikaho City, Mitane Town (excluding former Kotooka Town), Happou Town, Ogata Village
Ibaraki	Tsuchiura City (limited to former Niihari Village), Ishioka City, Hitachiomiya City (limited to former Miwa Village), Kasama City (limited to former Iwama Town), Chikusei City (excluding former Sekijo Town), Kasumigaura City (limited to former Chiyoda Town), Sakuragawa City, Omitama City (excluding former Tamari Village), Daigo Town
Gunma	Takasaki City (limited to former Kurabuchi Village), Kiryu City (limited to former Kurohone Village), Numata City (limited to former Numata City), Shibukawa City (limited to former Akagi Village and former Onogami Village), Annaka City (limited to former Matsuida Town), Midori City (limited to former Azuma Village, Seta Gun), Ueno Village, Kanna Town, Shimonita Town, Nanmoku Village, Nakanojo Town, Takayama Village, Higashiagatsuma Town, Showa Village, Minakami Town (excluding former Minakami Town)
Saitama	Chichibu City (limited to former Otaki Village), Ogano Town (limited to former Ryokami Village)
Tokyo	Okutama Town
Toyama	Toyama City (limited to former Osawano Town, former Ohyama Town, and former Hosoiri Village), Kurobe City (limited to former Unazuki Town), Nanto City (limited to former Taira Village, former Kamitaira Village, and former Toga Village), Kamiichi Town, Tateyama Town
Ishikawa	Hakusan City (limited to former Yoshinodani Village, former Oguchi Village, and former Shiramine Village)
Fukui	Ono City (limited to former Izumi Village)
Yamanashi	Kofu City (limited to former Kamikuishiki Village), Tsuru City, Yamanashi City (limited to former Mitomi Village), Hokuto City (excluding former Akeno Village and former Kobuchizawa Town), Ashigawa Village, Narusawa Village, Fujikawaguchiko Town (excluding former Kawaguchiko Town), Kosuge Village, Tabayama Village
Gifu	Nakatsugawa City (excluding former Nakatsugawa City and former Yamaguchi Village, Kiso Gun, Nagano Prefecture), Ena City (limited to former Kushihara Village and former Kamiyahagi Town), Hida City (limited to former Miyagawa Village

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	and former Kamioka Town), Gujo City (excluding former Minami Village), Gero City (excluding former Kanayama Town), Higashishirakawa Village
Aichi	Toyota City (limited to former Inabu Town)
Hyogo	Yabu City (limited to former Sekinomiya Town), Kami Town (excluding former Kasumi Town)
Nara	Nara City (limited to former Tsuge Village), Gojo City (limited to former Oto Village), Ikoma City, Uda City (limited to former Muro Village), Heguri Town, Nosegawa Village
Wakayama	Katsuragi Town (limited to former Hanazono Village), Koya City
Tottori	Kurayoshi City (limited to former Sekigane Town), Wakasa Town, Nichinan Town, Hino Town, Kofu Town
Shimane	Okuizumo Town, Iinan Town, Misato Town (limited to former Daiwa Village), Ohnan Town (excluding former Iwami Town)
Okayama	Tsuyama City (limited to former Awa Village), Takahashi City (limited to former Bittchu Town), Niimi City, Maniwa City (excluding former Ochiai Town and former Kuse Town), Shinjo Village, Kagamino Town (excluding former Kagamino Town)
Hiroshima	Fuchu City (limited to former Joge Town), Miyoshi City (excluding former Miyoshi City and former Miwa Town), Shobara City, Hatsukaichi City (limited to former Saiki Town and former Yoshiwa Village), Akitakata City (limited to former Yachiyo Town, former Midori Town, and former Takamiya Town), Akiota Town (excluding former Kake Town), Kitahiroshima Town (excluding former Toyohira Town), Sera Town (excluding former Sereanishi Town), Jinsekikogen Town
Tokushima	Miyoshi City (limited to former Higashiiyayama Village)
Kochi	Ino Town (limited to former Hongawa Village)
4. The following municipalities should be classified as Area IV regardless of the above classification:	
Fukushima	Iwaki City, Hirono Town, Naraha Town, Tomioka Town, Okuma Town, Futaba Town
Tochigi	Utsunomiya City, Ashikaga Town, Tochigi Town, Sano Town, Kanuma Town, Oyama Town, Moka City, Sakura City (limited to former Ujiie Town), Nasukarasuyama Town, Shimotsuke City, Kaminokawa Town, Kamikawachi Town, Kawachi Town, Nishikata Town, Ninomiya Town, Masuko Town, Motegi Town, Ichikai Town, Haga Town, Mibu Town, Nogi Town, Ohira Town, Fujioka Town, Iwafune Town, Tsuga Town, Takanezawa Town
Niigata	Niigata City, Nagaoka City (limited to former Nakanoshima Town, former Mishima Town, former Yoita Town, former Washima Village, and former Teradomari Town), Sanjo City (excluding former Shitada Village), Kashiwazaki City (excluding former Takayanagi Town), Shibata City, Mitsuke City, Murakami City, Tsubame City, Itoigawa City, Joetsu City (limited to former Joetsu City, former Kakizaki Town, former Ogata Town, former Kubiki Village, former Yoshikawa Town, former Sanwa Village, and former Nadachi Town), Agano City (limited to former Kyogase Village and former Sasakami Village), Sado City, Tainai City, Seiro Town, Yahiko Village, Izumozaki Town, Kariwa Village, Arakawa Town, Kamihayashi Village, Sanpoku Town, Awashimaura Village
Nagano	Seinaiji Village, Ooshika Village
Miyazaki	Miyakonojo City (excluding former Yamanokuchi Town and former Takajo Town), Nobeoka City (limited to former Kitakata Town), Kobayashi City, Ebino City, Takaharu Town, Nishimera Village, Morotsuka Village, Shiiba Village, Misato Town, Takachiho Town, Hinokage Town, Gokase Town
Kagoshima	Okuchi City, Soo City, Kirishima City (limited to former Yokogawa Town, former Makizono Town, and former Kirishima Town), Satsuma Town, Hishikari Town, Yusui Town
5. The following municipalities should be classified as Area V regardless of the above classification:	
Ibaraki	Kamisu City (limited to former Hasaki Town)
Chiba	Choshi City
Tokyo	Oshima Town, Toshima Village, Niijima Village, Kozushima Village, Miyake Village, Mikurajima Village, Hachijo Town, Aogashima Village, Ogasawara Village
Shizuoka	Atami City, Shimoda City, Omaezaki City, Kawazu Town, Minamiizu Town, Matsuzaki Town, Nishiizu Town (limited to former Nishiizu Town)
Mie	Owase City, Kumano City (limited to former Kumano City), Mihama Town, Kiho Town
Wakayama	Gobo City, Shingu City (limited to former Shingu City), Hirogawa Town, Mihama Town, Hidaka Town, Yura Town, Shirahama Town, Susami Town, Kushimoto Town, Nachikatsuura Town, Taiji Town, Kozagawa Town
Yamaguchi	Shimonoseki City (limited to former Shimonoseki City)
Tokushima	Mugi Town, Minami Town, Kaiyo Town
Ehime	Uwajima Town (limited to former Tsushima Town), Ikata Town (excluding former Ikata Town), Ainan Town
Kochi	Kochi City (limited to former Kochi City), Muroto City, Aki City, Nankoku City, Tosa City, Susaki City, Sukumo City, Tosashimizu City, Konan City, Toyo Town, Nahari Town, Tano Town, Yasuda Town, Kitagawa Village, Umaji Village, Geisei Village, Haruno Town, Ino Town (limited to former Ino Town), Otsuki Town, Mihara Village, Kuroshio Town (limited to former Ogata Town)
Fukuoka	Fukuoka City: Hakata-ku, Chuo-ku, Minami-ku, and Jonan-ku
Nagasaki	Nagasaki City, Sasebo City, Shimabara City (limited to former Shimabara City), Hirato City, Goto City, Saikai City, Minamishimabara City (excluding former Kazusa Town), Nagayo Town, Togitsu Town, Ojika Town, Emukae Town, Shikamachi Town, Saza Town, Shinkamigoto Town
Kumamoto	Yashiro City (limited to former Yashiro City, former Sencho Town, and former Kagami Town), Minamata City, Kamiamakusa Town (excluding former Matsushima Town), Uki City (limited to former Misumi Town), Amakusa City (excluding former Ariake Town and former Itsuwa Town), Ashikita Town, Tsunagi Town
Oita	Saiki City (limited to former Saiki City, former Tsurumi Town, former Yonouzu Village, and former Kamae Town)

Note: Classifications of cities (including special cities), towns, and villages shown in the above table are effective as of April 1, 2006.

(Reference 2) Appendix 2 of the "Judgment Criteria for Building Owners for Energy Efficiency Standards"

Appendix 2

Area classification	Prefectures (excluding Okinawa)
A	Hokkaido, Aomori, Akita, Yamagata, Niigata, Ishikawa
B	Iwate, Toyama, Fukui, Gifu, Shiga, Kyoto, Nara, Tottori, Shimane, Hiroshima
C	Miyagi, Fukushima, Nagano, Osaka, Hyogo, Okayama, Yamaguchi, Ehime, Fukuoka, Saga, Nagasaki
D	Ibaraki, Tochigi, Gunma, Saitama, Chiba, Tokyo, Kanagawa, Yamanashi, Aichi, Mie, Wakayama, Tokushima, Kagawa, Kumamoto, Oita
E	Shizuoka, Kochi, Miyazaki, Kagoshima

1. The following municipalities should be classified as Area A regardless of the above classification:

Iwate: Hachimantai City (limited to former Ashiro Town), Kuzumaki Town, Nishiwaga Town

Fukushima: Kitakata City (excluding former Kitakata City and former Shiokawa Town), Shimogo Town, Hinoemata Village, Tadami Town, Minamiaizu Town, Kitashiobara Village, Nishiaizu Town, Yanaizu Town, Mishima Town, Kaneyama Town, Showa Village, Aizumisato Town (limited to former Aizutakada Town)

Toyama: Himi City

Shimane: Iinan Town, Misato Town (limited to former Daiwa Village)

2. The following municipalities should be classified as Area B regardless of the above classification:

Hokkaido: Sapporo City, Hakodate City, Muroran City, Kushiro City, Obihiro City, Kitami City (excluding former Rubeshibe Town), Abashiri City, Tomakomai City, Nemuro City, Chitose City, Noboribetsu City, Eniwa City, Hokuto City (limited to former Ono Town), Nanae Town, Shikabe Town, Mori Town, Naganuma Town, Bihoro Town, Tsubetsu Town, Ozora Town, Koshimizu Town, Kunneppu Town, Oketo Town, Engaru Town (limited to former Engaru Town), Kamiyubetsu Town, Yubetsu Town, Shiraoi Town, Atsuma Town, Abira Town, Mukawa Town, Hidaka Town (limited to former Monbetsu Town), Biratori Town, Niikappu Town, Urakawa Town, Samani Town, Erimo Town, Shinhidaka Town, Otofuke Town, Shihoro Town, Kamishihoro Town, Shikaoi Town, Shintoku Town, Shimizu Town, Memuro Town, Nakasatsunai Village, Sarabetsu Village, Taiki Town, Hiroo Town, Makubetsu Town, Ikeda Town, Toyokoro Town, Honbetsu Town, Ashoro Town, Rikubetsu Town, Urahoro Town, Kushiro Town, Akkeshi Town, Hamanaka Town, Shibecha Town, Teshikaga Town, Tsurui Village, Shiranuka Town, Betsukai Town, Nakashibetsu Town, Shibetsu Town

Aomori: Hachinohe City, Towada City (limited to former Towada City), Misawa City, Shichinohe Town (limited to former Shichinohe Town), Rokunohe Town, Tohoku Town (limited to former Kamikita Town), Rokkasho Village, Oirase Town, Higashidoori Village, Sannohe Town, Gonohe Town, Takko Town, Nanbu Town, Hashikami Town, Shingo Village

Miyagi: Tome City (excluding former Tome Town, former Toyosato Town, former Yoneyama Town, and former Tsuyama Town), Kurihara City, Osaki City (limited to former Iwadeyama Town and former Naruko Town), Zao Town, Shichikashuku Town, Murata Town, Kawasaki Town, Taiwa Town, Tomiya Town, Ohira Village, Shikama Town, Kami Town

Yamagata: Yamagata City, Kaminoyama City, Tendo City, Higashine City, Yamanobe Town, Nakayama Town

Fukushima: Fukushima City, Aizuwakamatsu City, Shirakawa City (limited to former Taishin Village), Sukagawa City (excluding former Sukagawa City), Kitakata City (limited to former Kitakata City and former Shiokawa Town), Nihonmatsu City (excluding former Iwashiro Town), Date City (limited to former Date Town and former Tsukidate Town), Koori Town, Kunimi Town, Kawamata Town, Iino Town, Otama Village, Motomiya Town, Kagamiishi Town, Ten-ei Village, Bandai Town, Inawashiro Town, Aizubange Town, Yugawa Village, Aizumisato Town (excluding former Aizutakada Town), Nishigo Village, Yabuki Town, Iitate Village

Tochigi: Nikko City (limited to former Kuriyama Village and former Fujihara Town), Nasu Town

Gunma: Tsumagoi Village, Kusatsu Town, Katashina Village, Minakami Town (excluding former Tsukiyono Town)

Niigata: Itoigawa City (excluding former Nou Town), Myoko City, Joetsu City (limited to former Maki Village, former Nakago Village, former Itakura Town, and former Kiyosato Village), Yuzawa Town, Tsunan Town

Ishikawa: Kanazawa City, Kaga City (limited to former Yamanaka Town), Kahoku City, Hakusan City (limited to former Matsuto City and former Shiramine Village), Nonoichi Town, Tsubata Town, Uchinada Town

Nagano: Nagano City, Matsumoto City (limited to former Nagawa Village and former Azumi Village), Suzaka City, Nakano City, Omachi City, Iiyama City, Shiojiri City (limited to former Narakawa Village), Azumino City (limited to former Hotaka Town and former Horigane Village), Seinaiji Village, Achi Village, Hiraya Village, Neba Village, Shimojo Village, Agematsu Town, Nagiso Town, Kiso Town, Otaki Village, Ookuwa Village, Kiso Town, Ikusaka Village, Ikeda Town, Matsukawa Village, Hakuba Village, Otari Village, Obuse Town, Takayama Village, Yamanouchi Town, Kishimadaira Village, Nozawaonsen Village, Shinshushinmachi Town, Shinano Town, Ogawa Village, Nakajo Village, Iizuna Town, Sakae Village

Gifu: Nakatsugawa City (limited to former Yamaguchi Village, Nagano Prefecture)

Aichi: Toyota City (limited to former Inabu Town)

Hyogo: Toyooka City, Yabu City, Tamba City (limited to former Hikami Town, former Aogaki Town, and former Ichijima Town), Asago City, Shiso City, Taka Town (limited to former Kami Town), Kamikawa Town, Kami Town, Shinonsen Town

Wakayama: Tanabe City (limited to former Ryujin Village), Kimino Town (limited to former Misato Town), Katsuragi Town (limited to former Hanazono Village), Koya Town, Aridagawa Town (limited to former Shimizu Town), Hidakagawa Town (limited to former Miyama Village)

Okayama: Tsuyama City (excluding former Tsuyama City), Niimi City, Maniwa City, Mimasaka City (limited to former Katsuta Town, former Ohara Town, and former Higashiawakura Village), Shinjo Village, Kagamino Town, Nagi Town, Nishiawakura Village

Yamaguchi: Hagi City, Nagato City, Abu Town, Ato Town

Tokushima: Miyoshi City (excluding former Mino Town and former Yamashiro Town)

Ehime: Ozu City (limited to former Kawabe Village), Kumakogen Town, Tobe Town (limited to former Hirota Village), Uchiko Town

3. The following municipalities should be classified as Area C regardless of the above classification:

Iwate: Miyako City (excluding former Niisato Village), Ofunato City (limited to former Ofunato City), Kuji City (limited to former Kuji City), Rikuzentakata City, Yamada Town, Tanohata Village, Fudai Village, Noda Village

Ibaraki: Ishioka City, Hitachiota City (limited to former Suifu Village and former Satomi Village), Hitachiomiya City (limited to former Yamagata Town and former Miwa Village), Kasumigaura City (limited to former Chiyoda Town), Sakuragawa City (limited to former Makabe Town), Daigo Town

Tochigi: Nikko City (excluding former Kuriyama Village and former Fujihara Town), Ohtawara City, Yaita City, Nasushiobara City, Sakura City, Kamikawachi Town, Shioya Town, Nakagawa Town

Gunma: Takasaki City (limited to former Kurabuchi Village), Numata City, Shibukawa City (limited to former Akagi Village, former Komochi Village, and former Onogami Village), Midori City (limited to former Azuma Village, Seta Gun), Ueno Village, Kanna Town (limited to former Nakazato Village), Nakanojo Town, Naganohara Town, Kuni Village, Takayama Village, Higashiagatsuma Town, Kawaba Village, Showa Village, Minakami Town (limited to former Tsukiyono Town)

Saitama: Chichibu City (limited to former Otaki Village), Ogano Town, Kamikawa Town (limited to former Kamiizumi Village)

Yamanashi: Kofu City (limited to former Kamikuishiki Village), Fujiyoshida City, Yamanashi City (limited to former Mitomi Village), Hokuto City (limited to former Takane Town, former Nagasaka Town, and former Oizumi Village), Ashigawa Village, Ichikawamisato Town (limited to former Mitama Town), Oshino Village, Yamanakako Village, Narusawa Village, Fujikawaguchiko Village (limited to former Kamikuishiki Village and former Ashiwada Village)

Gifu: Ogaki City (limited to former Kamiishizu Town), Tajimi City, Seki City (excluding former Horado Village and former Itadori Village), Nakatsugawa City (limited to former Nakatsugawa City and former Nijikawa Village), Mino City, Mizunami City,

	Ena City (excluding former Kushihara Village and former Kamiyahagi Town), Minokamo City, Toki City, Kani City, Yamagata City (excluding former Miyama Town), Motosu City (limited to former Motosu Town), Gujo City (limited to former Minami Village), Gero City (limited to former Kanayama Town), Kaizu City (limited to former Nannou Town), Yoro Town, Tarui Town, Sekigahara Town, Godo Town, Ibigawa Town (limited to former Ibigawa Town, former Tanigumi Village, and former Kasuga Village), Ono Town, Ikeda Town, Sakahogi Town, Tomika Town, Kawabe Town, Hichiso Town, Yaotsu Town, Shirakawa Town, Mitake Town
Shizuoka	Oyama Town
Aichi	Kasugai City, Toyota City (excluding former Toyota City and former Inabu Town), Inuyama City, Komaki City, Oguchi Town, Fuso Town, Shitara Town, Toei Town, Toyone Village
Mie	Tsu City (limited to former Geino Town, former Hakusan Town, and former Misugi Village), Matsusaka City (limited to former Iinan Town and former Iitaka), Nabari City, Kameyama City, Inabe City, Iga City, Toin Town, Komono Town
Kyoto	Kyoto City (limited to former Kyoto City), Uji City, Kameoka City, Joyo City, Muko City, Nagaokakyo City, Yawata City, Kyotanabe City, Oyamazaki Town, Kumiyama Town, Ide Town, Ujitawara Town, Yamashiro Town, Kizu Town, Kamo Town, Kasagi Town, Wazuka Town, Seika Town, Minamiyamashiro Village
Shiga	Otsu City, Omihachiman City, Kusatsu City, Moriyama City, Ritto City, Koka City (limited to former Minakuchi Town), Yasu City, Konan City, Higashiomi City (excluding former Aito Town and former Koto Town), Azuchi Town, Ryuoh Town, Aisho Town (limited to former Echigawa Town), Taga Town
Nara	Nara City (limited to former Nara City), Gojo City (limited to former Gojo City), Gose City, Ikoma City, Kashiba City, Katsuragi City, Heguri Town, Sango Town, Soni Village, Mitsue Village, Shimokitayama Village, Kamikitayama Village, Kawakami Village, Higashiyoshino Village
Wakayama	Kainan City (limited to former Kainan City), Hashimoto City, Tanabe City (limited to former Hongu Town), Kinokawa City, Kimino Town (limited to former Nokami Town), Iwade Town, Katsuragi Town (limited to former Katsuragi Town), Kudoyama Town, Aridagawa Town (limited to former Kanaya Town), Hidakagawa Town (limited to former Nakatsu Village)
Hiroshima	Hiroshima City (limited to former Hiroshima City), Takehara City, Mihara City, Onomichi City (excluding former Innoshima City and former Setoda Town), Fukuyama City, Fuchu City (limited to former Fuchu City), Otake City, Higashihiroshima City (excluding former Kurose Town), Hatsukaichi City (limited to former Hatsukaichi City and former Ono Town), Akitakata City (limited to former Yachiyo Town and former Mukaihara Town), Fuchu Town
Tokushima	Yoshinogawa City (excluding former Kamojima Town), Awa City (limited to former Ichiba Town and former Awa Town), Mima City, Miyoshi City (limited to former Mino Town and Yamashiro Town), Tsurugi Town, Higashimiyoshi Town
Kagawa	Takamatsu City (limited to former Shionoe Town, former Kagawa Town, and former Konan Town), Marugame City (limited to former Ayauta Town), Kannonji City, Mitoyoshi City (excluding former Mino Town, former Takuma Town, and former Nio Town), Ayagawa Town, Kotohira Town, Manno Town
Kochi	Motoyama Town, Otoyo Town, Tosa Town, Okawa Village, Ino Town (excluding former Ino Town), Niyodogawa Town, Ochi Town, Yusuhara Town, Tsuno Town (limited to former Higashitsuno Village)
Kumamoto	Yatsushiro City (limited to former Izumi Village), Kikuchi City (limited to former Kyokushi Village), Aso City, Misato Town (limited to former Tomochi Town), Ozu Town, Minamioguni Town, Oguni Town, Ubuyama Village, Takamori Town, Nishihara Village, Minamiaso Village, Mifune Town, Mashiki Town, Yamato Town, Mizukami Village
Oita	Nakatsu City (excluding former Nakatsu City), Hita City, Taketa City (limited to former Kuju Town), Usa City (excluding former Usa City), Yufu City (excluding former Hasama Town), Kokonoe Town, Kusu Town
Miyazaki	Gokase Town

4. The following municipalities should be classified as Area D regardless of the above classification:

Gifu	Gifu City, Ogaki City (excluding former Kamiishizu Town), Hashima City, Kakamigahara City, Mizuho City, Motosu City (limited to former Shinsei Town and former Itonuki Town), Kaizu City (excluding former Nannou Town), Ginan Town, Kasamatsu Town, Wanouchi Town, Anpachi Town, Kitagata Town
Shizuoka	Hamamatsu City (limited to former Tatsuyama Village, former Sakuma Town, former Misakubo Town, and former Inasa Town), Fujinomiya City, Gotemba City, Susono City, Shibakawa Town, Kawane Town, Kawanehoncho, Haruno Town
Osaka	Osaka City, Sakai City, Takaishi City, Tajiri Town
Hyogo	Kobe City, Himeji City (limited to former Ieshima Town), Amagasaki City, Akashi City, Nishinomiya City, Sumoto City, Ashiya City, Minamiawaji City, Awaji City, Harima Town
Okayama	Okayama City (excluding former Mitsu Town), Kurashiki City, Tamano City, Kasaoka City, Soja City (excluding former Soja City), Asakuchi City, Hayashima Town, Satosho Town
Hiroshima	Kure City, Onomichi City (limited to former Innoshima City and former Setoda Town), Higashihiroshima City (limited to former Kurose Town), Hatsukaichi City (limited to former Miyajima Town), Etajima City, Kaita Town, Kumano Town, Saka Town, Osakikamijima Town
Yamaguchi	Hofu City, Kudamatsu City, Iwakuni City (limited to former Iwakuni City and former Yuu Town), Hikari City, Yanai City, Suo-Oshima Town, Waki Town, Kaminoseki Town, Tabuse Town, Hirao Town
Ehime	Matsuyama City, Imabari City, Uwajima City (limited to former Tsushima Town), Kamijima Town, Masaki Town, Ikata Town (limited to former Misaki Town), Ainan Town
Kochi	Kochi City (excluding to former Kochi City), Shimanto City (limited to former Nishitosa Village), Kami City, Kitagawa Village, Umaji Village, Ino Town (limited to former Ino Town), Nakatosa Town (limited to former Onomi Village), Sakawa Town, Hidaka Village, Tsuno Town (limited to former Hayama Village), Shimanto Town
Fukuoka	Omuta City, Kurume City (limited to former Jojima Town and former Mizuma Town), Yanagawa City, Chikugo City, Okawa City, Oki Town, Setaka Town, Yamakawa Town, Takata Town
Saga	Saga City (limited to former Saga City and former Morodomi Town), Ogi City (limited to former Ashikari Town), Kanzaki City (limited to former Chiyoda Town), Kawasoe Town, Higashiyoka Town, Kubota Town, Tara Town
Nagasaki	Nagasaki City, Sasebo City (limited to former Sasebo City), Shimabara City, Isahaya City (limited to former Tarami Town and former Konagai Town), Tsushima City, Saikai City (excluding former Seihi Town), Unzen City (limited to former Kunimi Town, former Mizuho Town, and former Minamikushiyama Town), Minamishimabara City (excluding Arie Town, former Futsu Town, and former Fukae Town), Nagayo Town, Togitsu Town
Miyazaki	Ebino City, Nishimera Village, Morotsuka Village, Shiiba Village, Misato Town (limited to former Nango Village), Takachiho Town, Hinokage Town
Kagoshima	Akune City, Izumi City, Okuchi City, Satsumasendai City, Hioki City (excluding former Ijuin Town), Kirishima City, Ichikikushikino City, Minamisatsuma City (excluding former Bonotsu Town), Kawanabe Town, Satsuma Town, Nagashima Town, Hishikari Town, Kajiki Town, Aira Town, Kamou Town, Yusui Town

5. The following municipalities should be classified as Area E regardless of the above classification:

Tokyo	Hachijo Town, Aogashima Village, Ogasawara Village
Kanagawa	Yokohama City, Yokosuka City, Miura City, Hayama Town
Aichi	Toyohashi City, Tahara City
Mie	Ise City (limited to former Ise City and former Futami Town), Owase City, Toba City, Kumano City (limited to former Kumano City), Shima City, Taiki Town (excluding former Omiya Town), Minamiise Town, Kihoku Town, Mihama Town, Kiho Town
Wakayama	Shingu City (limited to former Shingu City), Shirahama Town, Kamitonda Town, Susami Town, Nachikatsuura Town, Taiji Town, Kushimoto Town
Tokushima	Anan City (limited to former Anan City), Naka Town (limited to former Wajiki Town and former Aioi Town), Mugi Town, Minami Town, Kaiyo Town
Oita	Saiki City (limited to former Saiki City, former Tsurumi Town, former Yonouzu Village and former Kamae Town)

(Reference 3) Extract from the "Basic Policy for the Promotion of Procurement of Eco-Friendly Goods and Services" (determined by the Cabinet after partial revision on February 2, 2007)

17. Public Works
(1) Items and Evaluation Criteria

Public Works	Evaluation Criteria: Contracts with participants, vendors, and contractors building public works shall require the use of materials, construction machines, processes, and targets listed in Table 1 that reduce the environmental load of the public works project.

Note: It is preferable to implement obligatory clauses within the overall framework that considers reduction of the environmental load.

(2) Establishment of Targets

It has been decided that the method of establishing targets will be studied when advancing future studies on how to identify results, etc.

Table 1 Materials, construction machines, construction methods, and items

Designated procurement item	Category	Item		Evaluation criterion for each item
		Item type	Item name	
Public works	Materials	Filling materials, etc.	Treated soil recycled from construction sludge	Table 2
			Granulated blast-furnace slag for earth work	
			Caisson filler using copper slag	
			Caisson filler using ferronickel slag	
		Ground improvement materials	Steel slag for ground improvement	
		Slag aggregates used for concrete	Blast-furnace slag aggregate	
			Ferronickel slag aggregate	
			Copper slag aggregate	
			Electric furnace oxidizing slag aggregate	
		Asphalt compounds	Recycled heated asphalt compound	
			Asphalt compound with steel slag	
		Roadbed materials	Recycled aggregate, etc.	
			Roadbed material with steel slag	
		Small-diameter logs	Timber obtained from thinning	
		Blended cements	Blast-furnace cement	
			Fly-ash cement	
		Cement	Eco-cement	
		Concrete and concrete products	Water-permeable concrete	
		Spray-on concrete	Spray-on concrete with fly-ash	
		Paints	Base-coating paint (anticorrosive)	
			Water-based road paint using low-volatility organic solvent	
		Pavement materials	Pavement blocks using recycled material (fired)	
			Pavement block products using recycled material (precast unreinforced-concrete products)	
		Gardening materials	Bark compost	
			Fermented compost using sewage sludge (sewage sludge compost)	
		Road illuminations	Environmentally friendly road illuminations	
		Tiles	Porcelain tiles	
		Doors and windows	Heat-insulating sashes and doors	
		Timber, etc.	Timber	
			Glued laminated wood	
			Plywood	
			Laminated veneer wood	
		Flooring	Flooring	
		Recycled wooden boards	Particleboard	
			Fiberboard	
			Wood-type cement board	
		Vinyl floor coverings	Vinyl floor covering	

		Insulation	Insulation	
		Lighting fixtures	Lighting control system	
		Air-conditioning units	Cold- and hot-water absorption units	
			Ice thermal storage air-conditioning units	
			Gas engine heat pump air-conditioning units	
		Plumbing materials Sanitary fixtures	Recycled rigid vinyl chloride drain/ventilation pipe	
			Automatic-shutoff faucets	
			Automatic flushing system, and urinals equipped with automatic flushing system	
			Flushing toilets	
	Construction machines	-	Low-emission construction machines	Table 3
			Low-noise construction machines	
	Construction methods	Effective usage of soil resulting from construction	Effective usage of low-quality soil	Table 4
		Recycling treatment of construction sludge	Recycling treatment of construction sludge	
		Recycling treatment of concrete masses	Recycling treatment of concrete masses	
		Pavement (roadbed)	Roadbed recycling method	
		Sloping surface greening method	Sloping surface greening method using wood offcuts or soil generated from construction process	
	Objective items	Paving	Drainage pavement	Table 5
			Permeable pavement	
		Greening of rooftops	Greening of rooftops	

Table 2 (Materials)

Item type	Item name	Evaluation criteria, etc.
Banking materials, etc.	Treated soil recycled from construction sludge	**Evaluation criterion** Must be treated soil recycled from construction sludge.
	Granulated blast-furnace slag for earth work	**Evaluation criterion** Earthworks material using blast-furnace slag that can replace part or all of natural sand (sea sand and land sand), natural gravel, crushed sand, or crushed stone.
	Caisson filler using copper slag	**Evaluation criterion** Caisson filler using copper slag that can replace part or all of natural sand (sea sand and land sand), natural gravel, crushed sand, or crushed stone.
	Caisson filler using ferronickel slag	**Evaluation criterion** Caisson filler using ferronickel slag that can replace part or all of natural sand (sea sand and land sand), natural gravel, crushed sand, or crushed stone.
Ground improvement materials	Steel slag for ground improvement	**Evaluation criterion** Steel slag that can completely replace natural sand (sea sand and land sand) using the sand compaction pile method.
Asphalt compounds	Recycled heated asphalt compound	**Evaluation criterion** Includes aggregate manufactured from asphalt concrete masses.
	Asphalt compound with steel slag	**Evaluation criterion** Steel slag for roads is used as aggregate for heated asphalt compound.
Slag aggregates for concrete	Blast-furnace slag aggregate	**Evaluation criterion** Aggregate using blast-furnace slag that can replace part or all of natural sand (sea sand and land sand), natural gravel, crushed sand, or crushed stone.
	Ferronickel slag aggregate	**Evaluation criterion** Aggregate using ferronickel slag that can replace part or all of natural sand (sea sand and land sand), natural gravel, crushed sand, or crushed stone.
	Copper slag aggregate	**Evaluation criterion** Aggregate using copper slag that can replace part or all of natural sand (sea sand and land sand), natural gravel, crushed sand, or crushed stone.
	Electric arc furnace oxidizing slag aggregate	**Evaluation criterion** Aggregate using electric furnace oxidizing slag that can replace part or all of natural sand (sea sand and land sand), natural gravel, crushed sand, or crushed stone.
Roadbed materials	Recycled aggregate, etc.	**Evaluation criterion** Includes aggregate manufactured from asphalt concrete masses or concrete masses.

	Roadbed material with steel slag	**Evaluation criterion** Steel slag for roads is used for roadbed material.
Small-diameter logs	Timber obtained from thinning	**Evaluation criterion** Timber obtained from thinning that does not contain harmful decay or cracks is used.
Blended cements	Blast-furnace cement	**Evaluation criterion** Blast-furnace cement whose raw material contains more than 30% blast-furnace slag.
	Fly-ash cement	**Evaluation criterion** Fly-ash cement whose raw material contains more than 10% fly-ash.
Cement	Eco-cement	**Evaluation criterion** Cement that uses ash from incineration of city waste, etc. as the main ingredient. The cement must contain no less than 500 kg in dry weight of such waste material per 1 tonne of final product.

Note: Eco-cement is to be used for concrete structures and concrete products that do not require high strength.

Concrete and concrete products	Water-permeable concrete	**Evaluation criterion** Water permeability of the concrete exceeds 1×10^{-2} cm/sec.

Note: Eco-cement is to be used for concrete structures and concrete products that do not require high strength.

Spray-on concrete	Spray-on concrete with fly-ash	**Evaluation criterion** Spray-on concrete that includes at least 100 kg per 1 m^3 fly-ash in its admixture.
Paints	Base-coating paint (anticorrosive)	**Evaluation criterion** Does not contain pigment using lead or chrome.
	Water-based road paint using low-volatility organic solvent	Evaluation criterion Water-based road paint that contains no more than 5% of volatile organic compounds (VOCs) (ratio of volatile solvent to total volume of paint).
Pavement materials	Pavement blocks using recycled material (fired)	**Evaluation criteria** (1) Made using recycled material (materials such as those in the left-hand column of the table below, and preprocessed where indicated in the right-hand column) as the raw material, and fired. (2) Must contain 20% or more recycled material by weight (total weight when using multiple materials). The recycled material may not include scraps from the same factory that is usually used. **Considerations** Must conform with the regulations for soil contamination in terms of toxic heavy metals contained or posing a risk of release during construction or by rain, etc. **Table**

Category of source material used as recycled material	Preprocessing method
Quarry or kiln waste	No preprocessing required
Inorganic silica sand	
Steel slag	
Nonferrous slag	
Foundry sand	
Pottery shards	
Coal ash	
Building material waste	
Waste glass	
Paper sludge	
Aluminum sludge	
Polishing sand sludge	
Stone chips	
Municipal waste ash	Converted to liquid slag
Sewage sludge	Converted to ash or liquid slag
Waterworks sludge	No preprocessing required
Sludge from lakes, etc.	

	Pavement block products using recycled material	**Evaluation criteria** (1) Made using recycled material (materials such as those in the left-hand column of the table below, and preprocessed where indicated in the right-hand

3

<table>
<tr><td></td><td>(precast unreinforced-concrete products)</td><td>column) as the raw material.
(2) Must contain 20% or more recycled material by weight (total weight when using multiple materials). In cases where it is necessary to increase the ratio of aggregates in order to maintain water permeability, the material must contain 15% or more recycled material by weight. The recycled material may not include scraps from the same factory that is usually used.

Considerations
Must conform with the regulations for soil contamination in terms of toxic heavy metals contained or posing a risk of release during construction or by rain, etc.

Table
<table>
<tr><td>Category of source material used as recycled material</td><td>Preprocessing method</td></tr>
<tr><td>Municipal waste ash</td><td rowspan="2">Converted to liquid slag</td></tr>
<tr><td>Sewage sludge</td></tr>
</table></td></tr>
<tr><td rowspan="2">Gardening materials</td><td>Bark compost</td><td>Evaluation criteria
Meets the following criteria:
- Percentage of organic material (dry): not less than 70%
- Carbon to nitrogen ratio (C/N ratio): not more than 35
- Cation exchange capacity (CEC) (dry): not less than 70 meq/100 g
- pH: 5.5 to 7.5
- Water content: 55 to 65%
- Result of young plant test: no abnormalities including growth inhibition recognized
- Nitrogen (N) content (actual): not less than 0.5%
- Phosphoric acid (P2O5) content (actual): not less than 0.2%
- Potassium (K2O) content (actual): not less than 0.1%</td></tr>
<tr><td>Fermented compost using sewage sludge (sewage sludge compost)</td><td>Evaluation criteria
(1) The percentages of hazardous chemicals contained in the product do not exceed the following:
Arsenic 0.005%
Cadmium 0.0005%
Mercury 0.0002%
Nickel 0.03%
Chrome 0.05%
Lead 0.01%
(2) Other restrictions:
a. The raw material used must meet the standards listed in Appendix 1 of the Ordinance Setting Judgment Criteria for Industrial Waste Containing Metal (Ordinance No. 5 of February 27, 1973, by the Prime Minister's Office).
b. No damage is detected in plant hazard testing.
c. Percentage of organic material (dry): not less than 35%
d. Carbon to nitrogen ratio (C/N ratio): not more than 20
e. pH: not more than 8.5
f. Water content: not more than 50%
g. Nitrogen (N) content (actual): not less than 0.8%
h. Phosphoric acid (P205) content (actual): not less than 1.0%
i. Alkaline content (actual): not more than 15% (This does not apply when used for the purpose of correcting the acidity of the soil.)</td></tr>
</table>

Note: Fermented compost using sewage sludge includes compost used as a soil conditioner.

Road illuminations	Environmentally friendly road illuminations	**Evaluation criterion** Road illumination equipment utilizing high-pressure sodium lamps, whose electricity consumption is more than 45% lower than illumination equipment using mercury lamps. **Considerations** The appropriate light source is to be selected taking into consideration the color appearance and color rendition desired for the site where the equipment is to be used.

<table>
<tr><td>Tiles</td><td>Porcelain tiles</td><td>Evaluation criteria
(1) Made using recycled material (materials such as those in the left-hand column of the table below, and preprocessed where indicated in the right-hand column) as the raw material.
(2) Must contain 20% or more recycled material by weight (total weight when using multiple materials). The recycled material may not include scraps from the same factory that is usually used.

Considerations
Must conform with regulations for soil contamination in terms of toxic heavy metals contained or posing a risk of release during construction or by rain, etc.

Table
<table>
<tr><td>Category of source material used as recycled material</td><td>Preprocessing Method</td></tr>
<tr><td>Quarry or kiln waste</td><td rowspan="15">No preprocessing required</td></tr>
<tr><td>Inorganic silica sand</td></tr>
<tr><td>Steel slag</td></tr>
<tr><td>Nonferrous slag</td></tr>
<tr><td>Foundry sand</td></tr>
<tr><td>Pottery shards</td></tr>
<tr><td>Coal ash</td></tr>
<tr><td>Waste plastic</td></tr>
<tr><td>Building material waste</td></tr>
<tr><td>Waste rubber</td></tr>
<tr><td>Waste glass</td></tr>
<tr><td>Paper sludge</td></tr>
<tr><td>Aluminum sludge</td></tr>
<tr><td>Polishing sand sludge</td></tr>
<tr><td>Stone chips</td></tr>
<tr><td>Municipal waste ash</td><td>Converted to liquid slag</td></tr>
<tr><td>Sewage sludge</td><td>Converted to ash or liquid slag</td></tr>
<tr><td>Waterworks sludge</td><td rowspan="2">No preprocessing required</td></tr>
<tr><td>Sludge from lakes, etc.</td></tr>
</table></td></tr>
<tr><td>Doors and windows</td><td>Heat-insulating sashes and doors</td><td>Evaluation criteria
Doors and windows that prevent loss of heat, while meeting any of the following criteria:
- Sashes using multi-glazed glass
- Double sashes
- Doors using insulation material or other effective method of insulation</td></tr>
<tr><td rowspan="2">Timber, etc.</td><td>Timber</td><td>Evaluation criteria
(1) The timber must be obtained from thinning, leftover forest wood, or small-diameter logs.
(2) For cases other than (1), the timber used must comply with the regulations concerning forestry in its country of origin.

Considerations
Timber used as the raw material (with the exception of timber obtained from thinning, leftover forest wood, and small-diameter logs) must be obtained from a forest under sustainable management.</td></tr>
<tr><td>Glued laminated wood

Plywood

Laminated veneer wood</td><td>Evaluation criteria
(1) Must contain 10% or more by volume of timber obtained from thinning; leftover wood blocks from plywood and wood processing factories, etc.; leftover forest wood; or small-diameter logs. Timber other than that described above must comply with the regulations concerning forestry in its country of origin.
(2) For cases other than (1), timber used (with the exception of timber obtained from thinning; wood blocks from plywood and wood processing factories, etc.; leftover forest wood; and small-diameter logs) must comply with the regulations concerning forestry in its country of origin.
(3) For material used in living space interiors, the average formaldehyde discharge must not exceed 0.3 mg/L and the maximum discharge must not exceed 0.4 mg/L.</td></tr>
</table>

		Considerations Timber other than timber obtained from thinning, leftover wood blocks from plywood and wood processing factories, etc., leftover forest wood, and small-diameter logs must be obtained from a forest under sustainable management.

Note: 1. “Timber,” “glued laminated wood,” “plywood,” and “laminated veneer wood” under consideration in the evaluation criteria of this section (referred to as “Timber, etc.”) are those for use in carpentry in buildings.
2. Evaluation criterion (2) for “Timber, etc.” is applicable only in cases where restrictions exist in terms of either function or supply and demand.
3. The measurement of formaldehyde discharge should be performed in accordance with the Japan Agricultural Standards (JAS).
4. Confirmation of the legality and sustainability of forests from which pulpwood for the production of wood and paper originates is to be conducted in accordance with the Forest Agency’s Guidelines for Verification of Legality and Sustainability of Wood and Wood Products (February 15, 2006). In cases where the contract between the lumber company and the processing and distributing companies was concluded prior to April 1, 2006, proof that the timber is legal in accordance with the Guidelines mentioned above is not necessary, on condition that the party handling the timber and products concerned provides documentary evidence that the said contract was concluded prior to April 1, 2006.

Flooring	Flooring	**Evaluation criteria** (1) Timber obtained from thinning; leftover wood blocks from plywood and wood processing factories, etc.; leftover forest wood; or small-diameter logs must be used. Timber other than that described above must comply with the regulations concerning forestry in its country of origin. (2) For cases other than (1), the timber used must comply with the regulations concerning forestry in its country of origin. (3) For material used in living space interiors, the average formaldehyde discharge must not exceed 0.3 mg/L and the maximum discharge must not exceed 0.4 mg/L. **Considerations** Timber other than that obtained from thinning, leftover wood blocks from plywood and wood processing factories, etc., leftover forest wood, and small-diameter logs must be obtained from a forest that is under sustainable management.

Note: 1. “Flooring” under consideration in the evaluation criteria of this section is that for use in carpentry in buildings.
2. Evaluation criterion (2) is applicable only in cases where restrictions exist in terms of either function or supply and demand.
3. The measurement of formaldehyde discharge should be performed in accordance with the Japan Agricultural Standards (JAS).
4. Confirmation of the legality and sustainability of forests from which pulpwood for the production of wood and paper originates is to be conducted in accordance with the Forest Agency’s Guidelines for Verification of Legality and Sustainability of Wood and Wood Products (February 15, 2006). In cases where the contract between the lumber company and the processing and distributing companies was concluded prior to April 1, 2006, proof that the timber is legal in accordance with the Guidelines mentioned above is not necessary, on condition that the party handling the timber and products concerned provides documentary evidence that the said contract was concluded prior to April 1, 2006.

Recycled wooden boards	Particle board Fiberboard Wood-type cement board	**Evaluation criteria** (1) At least 50% (by weight) of the material consists of plant fibers or wooden materials from recycled sources, such as leftover wood blocks from plywood and wood-processing factories, wood recovered from dismantled structures, used crates, unused low-quality chips from paper manufacturing, leftover forest wood, shrubs, and small-diameter logs (including timber obtained from thinning). The weight of glue, admixture, etc. (used to hold together wood compounds, such as phenol adhesives used in particleboard, and cement used in wood-based cement board) may be omitted from the 50% by weight calculation, on condition that these agents make up no more than 20% of the total volume of the compound material under consideration. (2) Wood materials other than recycled resources of leftover wood blocks from plywood and wood-processing factories, wood recovered from dismantled structures, used crates, unused low-quality chips from paper manufacturing, leftover forest wood, shrubs, and small-diameter logs (including timber obtained from thinning) must comply with the regulations concerning forestry in their country of origin.

		(3) For material used in living space interiors, the average formaldehyde discharge must not exceed 0.3 mg/L and the maximum discharge must not exceed 0.4 mg/L. **Considerations** Wood materials other than recycled resources of leftover wood blocks from plywood and wood-processing factories, wood recovered from dismantled structures, used crates, unused low-quality chips from paper manufacturing, leftover forest wood, shrubs, and small-diameter logs (including timber obtained from thinning) must be obtained from a forest under sustainable management.

Note: 1. The measurement of formaldehyde discharge should be performed in accordance with Japan Industrial Standards (JIS) A1460.

2. Confirmation of the legality and sustainability of forests from which pulpwood for the production of wood and paper originates is to be conducted in accordance with the Forest Agency's Guidelines for Verification of Legality and Sustainability of Wood and Wood Products (February 15, 2006). In cases where the contract between the lumber company and the processing and distributing companies was concluded prior to April 1, 2006, proof that the timber is legal in accordance with the Guidelines mentioned above is not necessary, on condition that the party handling the timber and products concerned provides documentary evidence that the said contract was concluded prior to April 1, 2006.

Insulation	Insulation	**Evaluation criteria** Material that prevents loss of heat through the outer walls of buildings, and meets the following criteria: (1) Does not use material harmful to the ozone layer. (2) Does not use hydrofluorocarbons (chlorofluorocarbon substitutes). (3) Uses recycled material, or can be recycled after use. (4) Recycled material used to manufacture glass wool and rock wool, or its by-products, must meet the following criteria: - Glass wool: Recycled material amounts to not less than 80% by weight of the raw material. - Rock wool: Recycled material amounts to not less than 85% by weight of the raw material. **Considerations** Insulation material made of plastic foam must maintain long-term insulation performance and use a material that has the smallest possible global warming potential.
Lighting fixtures	Lighting control system	**Evaluation criterion** Composed of high-frequency fluorescent lighting equipment capable of continuous lighting and a lighting control system that controls the equipment. It must possess functions for the control and correction of initial luminance and the control of natural light.
Transformers	Transformer	**Evaluation criterion** Energy consumption efficiency must not exceed the value determined by the appropriate formula for each category. **Considerations** The load factor during actual operation is to be taken into consideration.

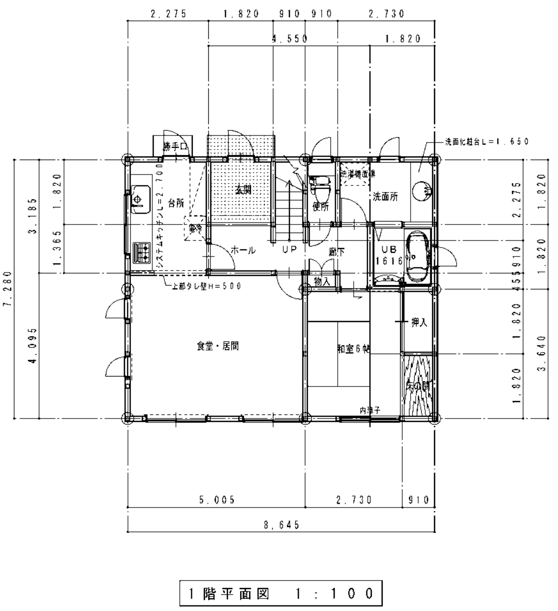
3

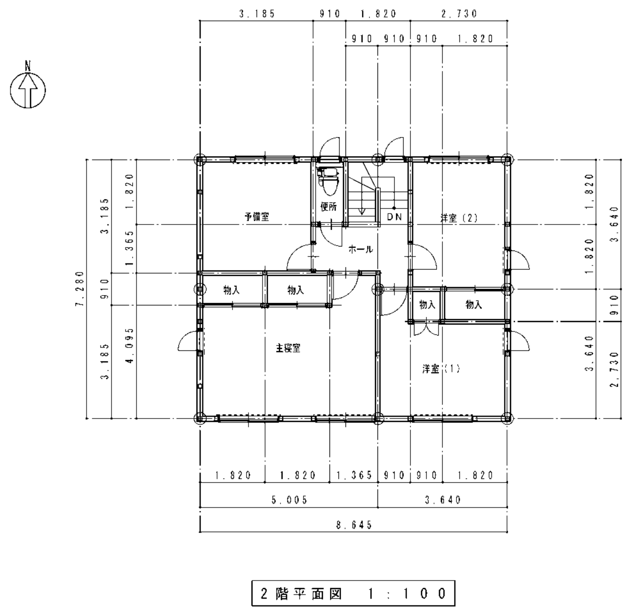
(Reference 4) "Standard Model House" for Life Cycle CO_2 Assessment

The conditions set for the "standard model house" used for CO_2 assessment in the "Construction" and "Repair, Renewal, and Demolition" stages are described below.

Outline:
Size: 2 stories above ground
Total floor area: 125.86 m^2 (62.93 m^2 for each floor)
Type of construction: Three types (wooden, steel, and reinforced concrete) are assumed.

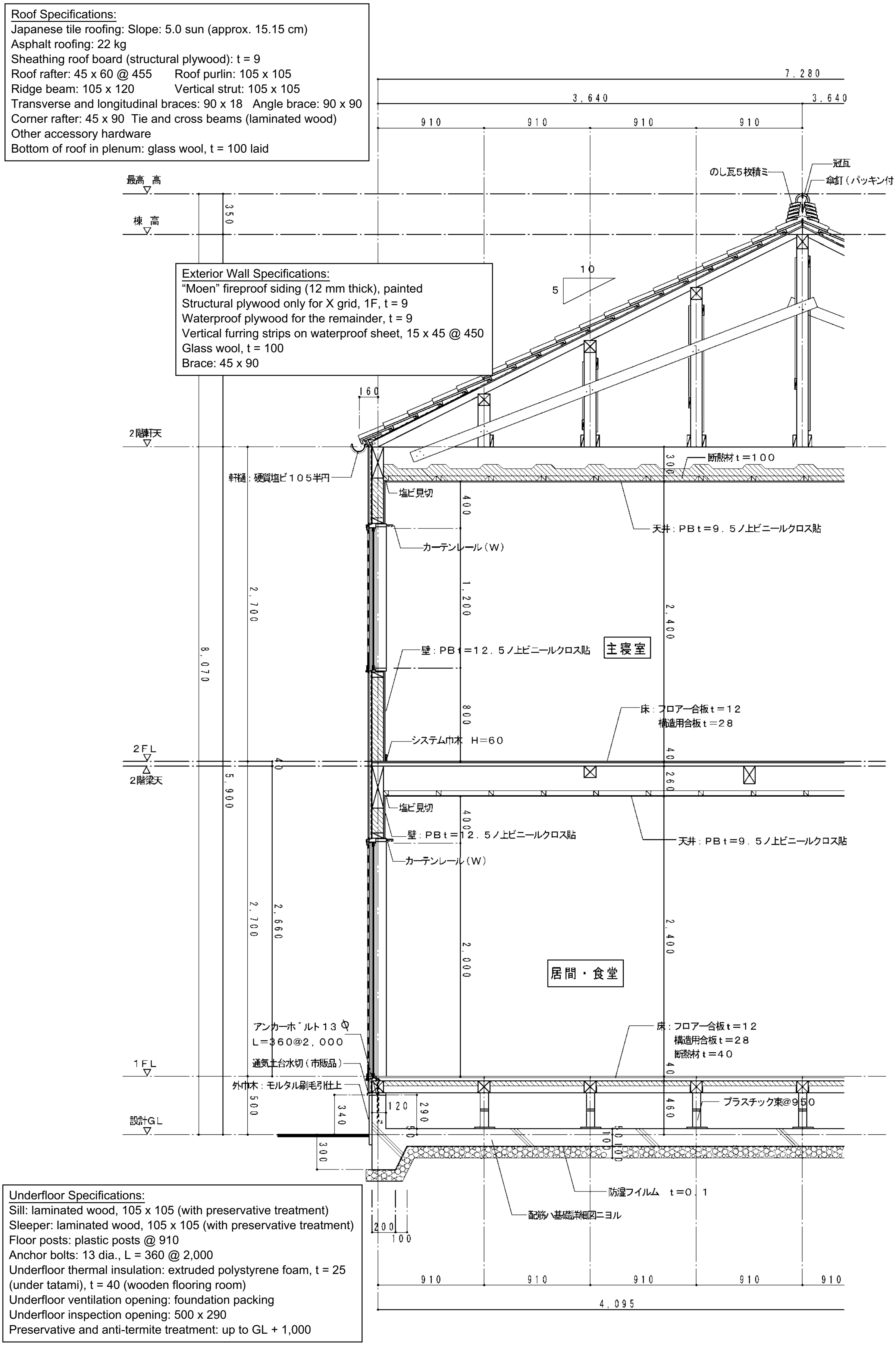
Wood:





Plan (wood)

Elevation (wood)



Detailed sectional drawing (wood)

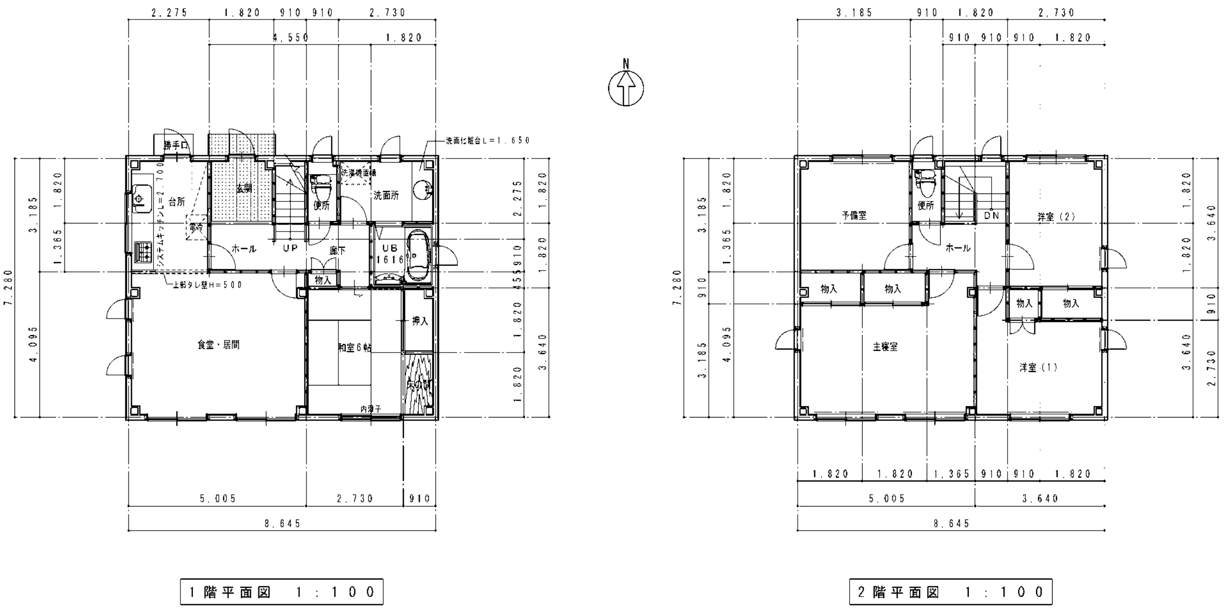
Exterior Finish Schedule

Roof	Roofing material	Japanese tile roofing; slope: 5.0 *sun* (approx. 15.15 cm)	Anti-termite structure	1F underfloor	Anti-termite treatment (5-year guarantee) (GL + 1000 mm spraying), soil treatment included
	Backing material for roofing	Asphalt roofing (22 kg)		Through pillar	Laminated wood (120 x 120)
	Roof groundwork	Roof boards (structural plywood), t = 9		Jointed pillar	Laminated wood (105 x 105)
	Rainwater gutters	Eaves gutter, 105/2 dia.; downspout, 60 dia. (PVC)		Girth	Floor beam, laminated wood
	Thermal insulation	Glass wool (100 mm thick)	Ceilings	Washroom, lavatory	Waterproof plasterboard (9.5 mm)
Exterior walls	Exterior wall material	"Moen" fireproof siding (12 mm thick), painted		Others	Plasterboard (9.5 mm)
	Backing for exterior wall material	Structural plywood, t = 9 (only for X grid, 1F); waterproof plywood, t = 9, for the remainder; backing waterproof sheet plus vertical furring strips, 15 x 40 @ 450	Partitions	Washroom, lavatory	Waterproof plasterboard (12.5 mm)
				Others	Plasterboard (12.5 mm)
	Interior material	Plasterboard, 12.5 mm		Western-style room opening frame	Decorated opening frame (decorated sheet)
	Thermal insulation	Glass wool, 100 mm thick			
	Aluminum sashes	Bronze white		Japanese-style room opening frame	Head jamb and doorsill (cypress laminated wood)
		Black only for entrance door			
Foundation	Foundation	Reinforced-concrete mat foundation; mortar brush finish; underfloor ventilated foundation packing; dampproof film, t = 0.1	Floor	Sills	Laminated wood, 105 x 105 (with preservative treatment)
				Sleepers	Laminated wood, 105 x 105 (with preservative treatment)
		Soil bearing capacity, Fe = 30 kN/m^2		Floor posts	Plastic posts, @ 910
	Entrance riser	Concrete block foundation		1F floor thermal insulation	Extruded polystyrene foam (40 mm thick), under tatami (2.5 mm thick)

Interior Finish Schedule

Story	Room name	Floor	Baseboard	Wall	Ceiling	Crown moldings	Finish	Remarks	Facilities	Others
1F	Entrance	Porcelain tiles, 100 x 100	Porcelain tiles, 100 x 100 System material, H = 60	Plasterboard (PB) for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified			
	Hall and corridors	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified			
	Living room and dining room	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Curtain rails (double)		
	Kitchen	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper; kitchen panel in front of kitchen	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	System kitchen L = 2,700	Ventilation fan, 25 cm	
	Japanese-style room	Styrofoam-core tatami, t = 55 (structural plywood, t = 28 subflooring)	Wooden edge strips	PB for sheathing, t = 12.5; Japanese-style vinyl wallpaper	Cedar plywood laminated jointed-type ceiling	Cypress laminated wood	Cypress laminated wood	Inner shoji screens; storage (middle shelf, upper shelf)		
	Alcove	Bottom board: zelkova laminated wood, t = 5 (structural plywood, t = 28 subflooring)	Finishing board	PB for sheathing, t = 12.5; Japanese-style vinyl wallpaper	Cedar plywood laminated jointed-type ceiling	Cypress laminated wood	Cypress laminated wood			
	Washroom	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	Waterproof PB for sheathing, t = 12.5; vinyl wallpaper (anti-mold)	Waterproof PB for sheathing, t = 9.5; vinyl wallpaper (anti-mold)	PVC trim	Ready-made PVC product unless otherwise specified	Wash counter, L = 1,650; towel hanger; faucet for washing	Pipe fan	
	Lavatory	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	Waterproof PB for sheathing, t = 12.5; vinyl wallpaper (anti-mold)	Waterproof PB for sheathing, t = 9.5; vinyl wallpaper (anti-mold)	PVC trim	Ready-made PVC product unless otherwise specified	Warmed toilet seat; towel hanger; toilet paper holder	Pipe fan	
	Bathroom	Unit bath (1616)								
2F	Hall	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified			
	Master bedroom	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Storage (middle shelf, upper shelf); curtain rails (double)		
	Western-style room 1	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Storage (middle shelf, upper shelf); curtain rails (double)		
	Western-style room 2	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Storage (middle shelf, upper shelf); curtain rails (double)		
	Spare room	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Curtain rails (double)		
	Lavatory	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	Waterproof PB for sheathing, t = 12.5; vinyl wallpaper (anti-mold)	Waterproof PB for sheathing, t = 9.5; vinyl wallpaper (anti-mold)	PVC trim	Ready-made PVC product unless otherwise specified	Warmed toilet seat; towel hanger; toilet paper holder	Pipe fan	
Common	Stairs	KSA Coordinate Series		PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified			
	Storage	Composite panel, t = 9		Lauan veneer, t = 5.5	Lauan veneer, t = 4.0	Western hemlock				

Steel:

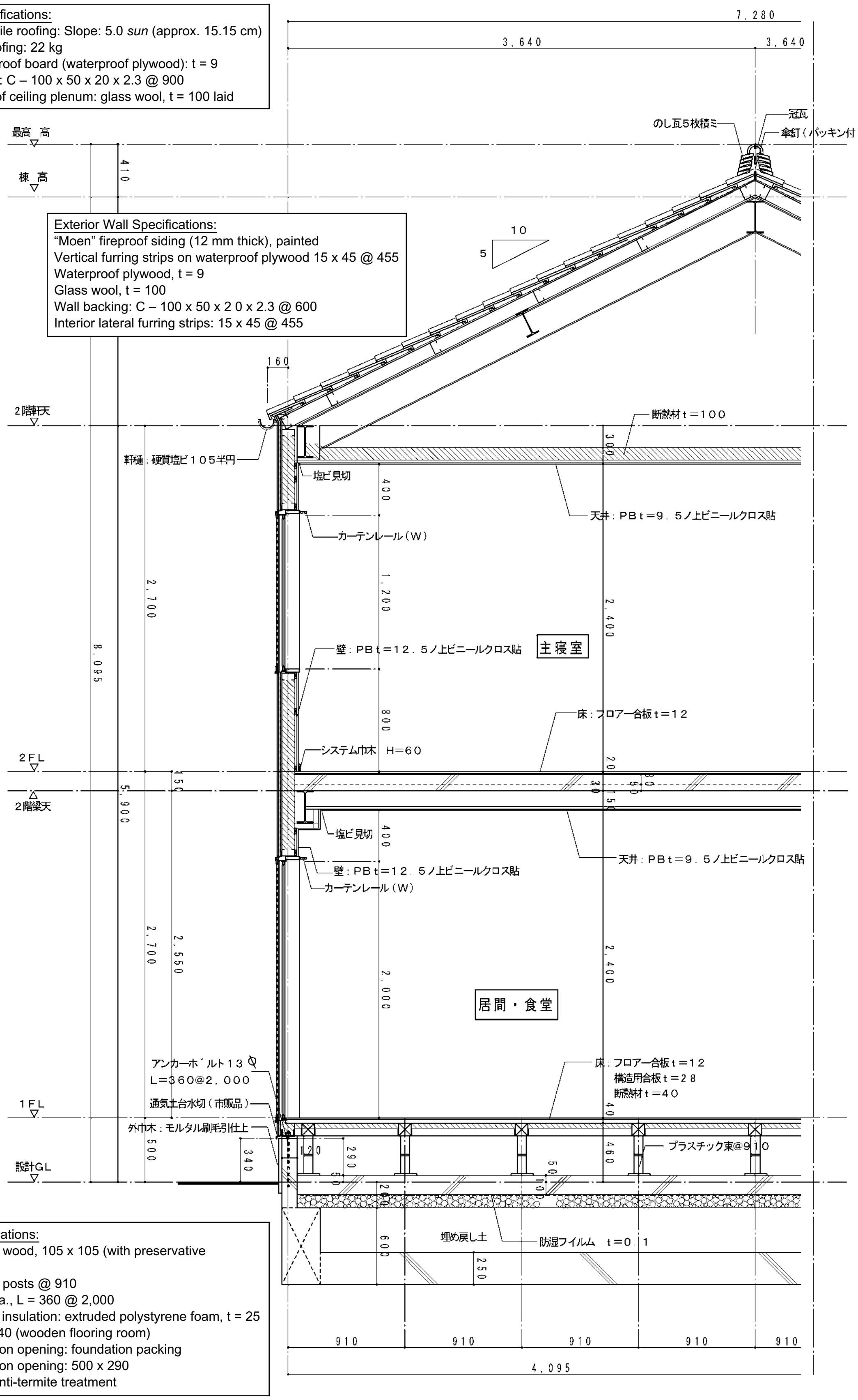


Plan (steel)

Elevation (steel))

Roof Specifications:
Japanese tile roofing: Slope: 5.0 *sun* (approx. 15.15 cm)
Asphalt roofing: 22 kg
Sheathing roof board (waterproof plywood): t = 9
Roof purlin: C – 100 x 50 x 20 x 2.3 @ 900
Roof side of ceiling plenum: glass wool, t = 100 laid

Exterior Wall Specifications:
"Moen" fireproof siding (12 mm thick), painted
Vertical furring strips on waterproof plywood 15 x 45 @ 455
Waterproof plywood, t = 9
Glass wool, t = 100
Wall backing: C – 100 x 50 x 2 0 x 2.3 @ 600
Interior lateral furring strips: 15 x 45 @ 455



Underfloor Specifications:
Sleeper: laminated wood, 105 x 105 (with preservative treatment)
Floor posts: plastic posts @ 910
Anchor bolts: 13 dia., L = 360 @ 2,000
Underfloor thermal insulation: extruded polystyrene foam, t = 25 (under tatami), t = 40 (wooden flooring room)
Underfloor ventilation opening: foundation packing
Underfloor inspection opening: 500 x 290
Preservative and anti-termite treatment

Detailed sectional drawing (steel))

3

Exterior Finish Schedule

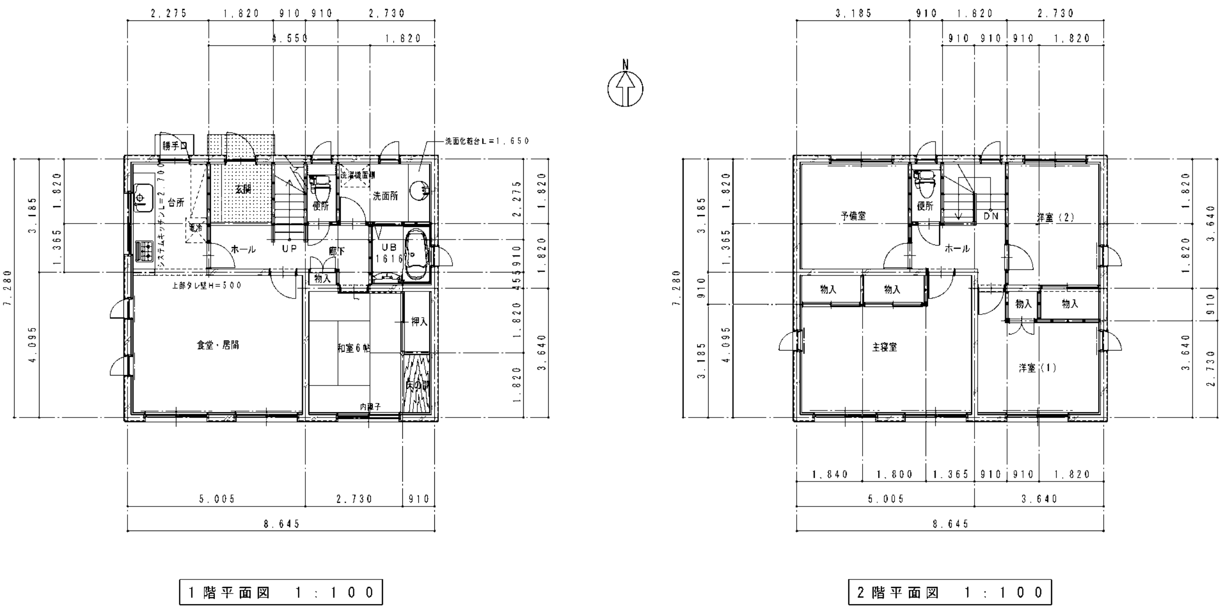
Roof	Roofing material	Japanese tile roofing; slope: 5.0 *sun* (approx. 15.15 cm)
	Backing material for roofing	Asphalt roofing (22 kg)
	Roof groundwork	Waterproof plywood, t = 9
		C – 100 x 50 x 20
	Rainwater gutters	Eaves gutter, 105/2 dia.; downspout, 60 dia. (PVC)
	Thermal insulation	Glass wool (100 mm thick)
Exterior wall	Exterior wall material	"Moen" fireproof siding (12 mm thick), painted
	Backing for exterior wall material	Waterproof plywood, t = 9; vertical furring strips on waterproof sheet, 15 x 45 @ 455
		C – 100 x 50 x 20
	Interior material	Plasterboard, 12.5 mm
	Thermal insulation	Glass wool, 100 mm thick
	Aluminum sashes	Bronze white
		Black only for entrance door
Foundation	Foundation	As per structural drawing
	Exterior baseboard	Mortar brush finish, H = 340
	Entrance riser	Concrete block foundation

Anti-termite structure	1F underfloor	Anti-termite treatment (5-year guarantee)
Ceiling (light-gauge steel: LGS)	Washroom, lavatory	Waterproof plasterboard (9.5 mm)
	Others	Plasterboard (9.5 mm)
Partitions (LGS)	Washroom, lavatory	Waterproof plasterboard (12.5 mm)
	Others	Plasterboard (12.5 mm)
	Western-style room opening frame	Decorated opening frame (decorated sheet)
	Japanese-style room opening frame	Head jamb and doorsill (cypress laminated wood)
Floor	Sleepers	Laminated wood, 105 x 105 (with preservative treatment)
	Floor posts	Plastic posts, @ 910
	1F floor thermal insulation	Extruded polystyrene foam (t = 40 mm), under tatami (25 mm thick)
	Doma-style (earthen, tiled, or stone-paved) floor	Concrete, t = 150; dampproof film, t = 0.1

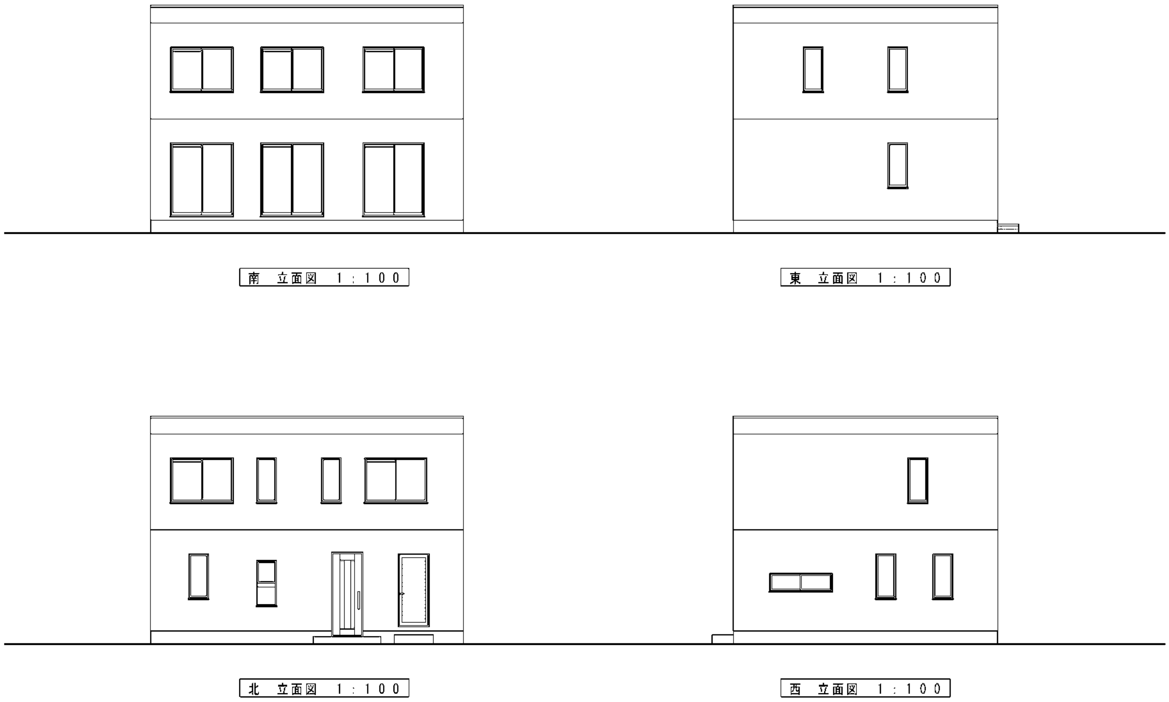
Interior Finish Schedule

Story	Room name	Floor	Baseboard	Wall	Ceiling	Crown moldings	Finish	Remarks	Facilities	Others
1F	Entrance	Porcelain tiles, 100 x 100	Porcelain tiles, 100 x 100; system material	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified			
	Hall and corridors	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified			
	Living room and dining room	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Curtain rails (double)		
	Kitchen	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper; kitchen panel in front of kitchen	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	System kitchen L = 2,700	Ventilation fan, 25 cm	
	Japanese-style room	Styrofoam-core tatami, t = 55 (structural plywood, t = 28 subflooring)	Wooden edge strips	PB for sheathing, t = 12.5; Japanese-style vinyl wallpaper	Cedar plywood laminated jointed-type ceiling	Cypress laminated wood	Cypress laminated wood	Inner shoji screens; storage (middle shelf, upper shelf)		
	Alcove	Bottom board: zelkova laminated wood, t = 5 (structural plywood, t = 28 subflooring)	Finishing board	PB for sheathing, t = 12.5; Japanese-style vinyl wallpaper	Cedar plywood laminated jointed-type ceiling	Cypress laminated wood	Cypress laminated wood			
	Washroom	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	Waterproof PB for sheathing, t = 12.5; vinyl wallpaper (anti-mold)	Waterproof PB for sheathing, t = 9.5; vinyl wallpaper (anti-mold)	PVC trim	Ready-made PVC product unless otherwise specified	Washroom counter, L = 1,650; towel hanger; faucet for washing	Pipe fan	
	Lavatory	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	Waterproof PB for sheathing, t = 12.5; vinyl wallpaper (anti-mold)	Waterproof PB for sheathing, t = 9.5; vinyl wallpaper (anti-mold)	PVC trim	Ready-made PVC product unless otherwise specified	Warmed toilet seat; towel hanger; toilet paper holder	Pipe fan	
	Bathroom	Unit bath (1616)								
2F	Hall	Floor plywood, t = 12 (flooring directly on concrete)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified			
	Master bedroom	Floor plywood, t = 12 (flooring directly on concrete)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Storage (middle shelf, upper shelf); curtain rails (double)		
	Western-style room 1	Floor plywood, t = 12 (flooring directly on concrete)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Storage (middle shelf, upper shelf); curtain rails (double)		
	Western-style room 2	Floor plywood, t = 12 (flooring directly on concrete)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Storage (middle shelf, upper shelf); curtain rails (double)		
	Spare room	Floor plywood, t = 12 (flooring directly on concrete)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Curtain rails (double)		
	Lavatory	Floor plywood, t = 12 (flooring directly on concrete)	System material, H = 60	Waterproof PB for sheathing, t = 12.5; vinyl wallpaper (anti-mold)	Waterproof PB for sheathing, t = 9.5; vinyl wallpaper (anti-mold)	PVC trim	Ready-made PVC product unless otherwise specified	Warmed toilet seat; towel hanger; toilet paper holder	Pipe fan	
Common	Stairs	KSA Coordinate Series		PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified			
	Storage	Plywood form, t = 9		Lauan veneer, t = 5.5	Lauan veneer, t = 4.0	Western hemlock				

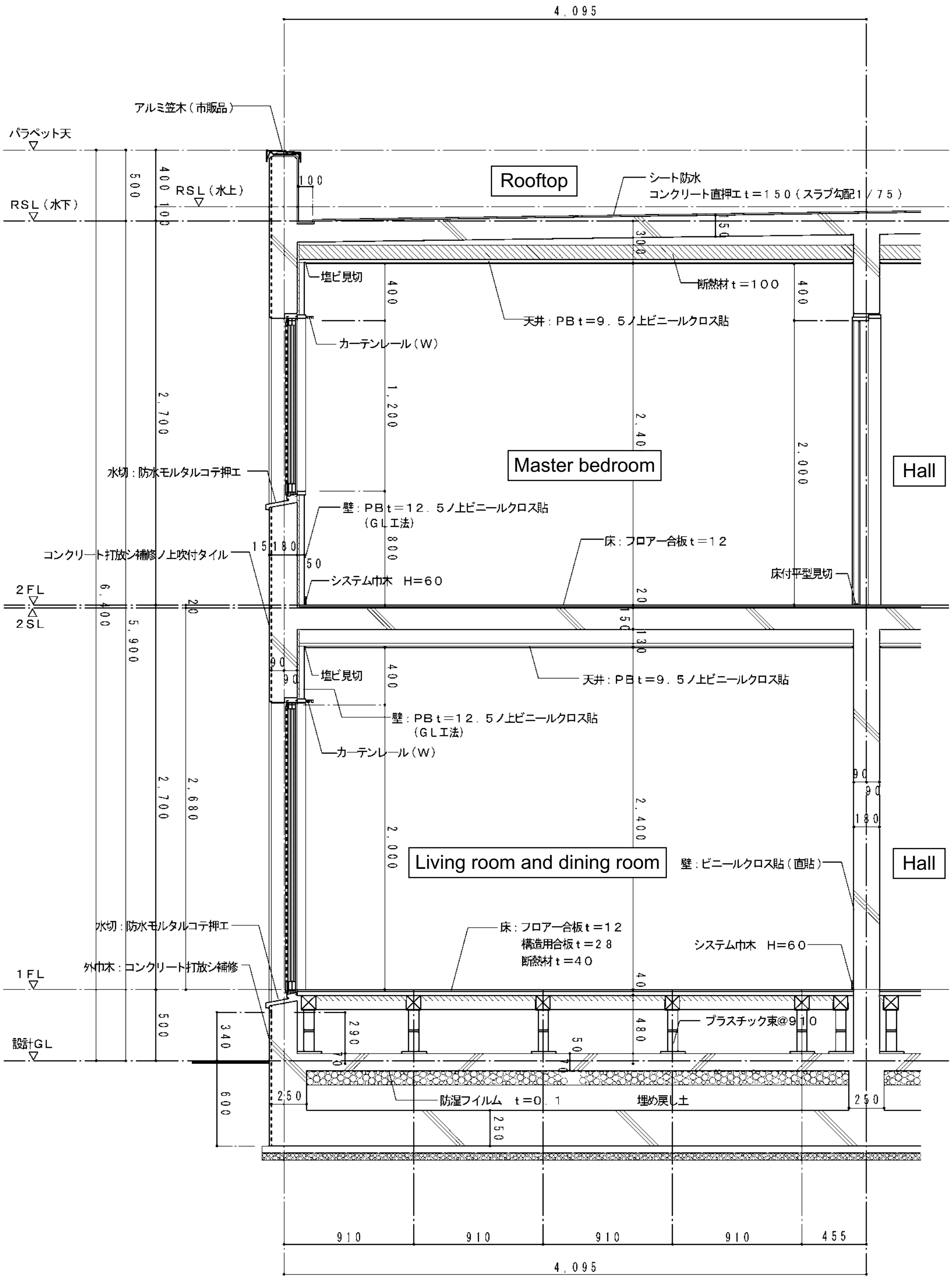
Reinforced concrete:



Plan (reinforced concrete)



Elevation (reinforced concrete)



Underfloor Specifications:
Sleeper: laminated wood, 105 x 105 (with preservative treatment)
Floor posts: plastic posts @ 910
Underfloor thermal insulation: extruded polystyrene foam, t = 25 (under tatami), t = 40 (wooden flooring room)
Underfloor inspection opening: 500 x 290
Preservative and anti-termite treatment

Sectional detailed drawing (reinforced concrete)

Exterior Finish Schedule

Rooftop	Finish material	Sheet waterproofing, t = 1.5	Anti-termite structure	1F underfloor	Anti-termite treatment (5-year guarantee)
	Sheathing roof board	Concrete slab with 1/75 slope			
	Coping	Aluminum coping (ready-made product)	Ceiling (LGS)	Washroom, lavatory	Waterproof plasterboard (9.5 mm)
	Rainwater gutters	Roof drain, 75 dia.; downspout, 75 dia., hard PVC		Others	Plasterboard (9.5 mm)
	Thermal insulation	Glass wool (100 mm thick)	Partitions (LGS)	Washroom, lavatory	Waterproof plasterboard (12.5 mm)
Exterior wall	Exterior wall material	Architectural concrete finishing plus touch-up and spray-type textured-finish paint		Others	Plasterboard (12.5 mm)
	Interior material	Plasterboard, t = 12.5 mm		Western-style room opening frame	Decorated opening frame (decorated sheet)
	Thermal insulation	Sprayed foam-in-place, t = 15 mm			
	Aluminum sash	Bronze white		Japanese-style room opening frame	Head jamb and doorsill (cypress laminated wood)
		Black only for entrance door			
Foundation	Foundation	As per structural drawing	Floor	Sleepers	Laminated wood, 105 x 105 (with preservative treatment)
	Exterior baseboard	Exposed concrete with touch-up, H = 340		Floor posts	Plastic posts, @ 910
	Entrance riser	Concrete block foundation		1F floor thermal insulation	Extruded polystyrene foam (t = 40 mm), under tatami (25 mm thick)
				Doma-style (earthen, tiled, or stone-paved) floor	Concrete, t = 150; dampproof film, t = 0.1

Interior Finish Schedule

Story	Room name	Floor	Baseboard	Wall	Ceiling	Crown moldings	Finish	Remarks	Facilities	Others
1F	Entrance	Porcelain tiles, 100 x 100	Porcelain tiles, 100 x 100; system material	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified			
	Hall and corridors	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified			
	Living room and dining room	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Curtain rails (double)		
	Kitchen	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper; kitchen panel in front of kitchen	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	System kitchen L = 2,700	Ventilation fan, 25 cm	
	Japanese-style room	Styrofoam-core tatami, t = 55 (structural plywood, t = 28 subflooring)	Wooden edge strips	PB for sheathing, t = 12.5; Japanese-style vinyl wallpaper	Cedar plywood laminated jointed-type ceiling	Cypress laminated wood	Cypress laminated wood	Inner shoji screens; storage (middle shelf, upper shelf)		
	Alcove	Bottom board: zelkova laminated wood, t = 5 (structural plywood, t = 28 subflooring)	Finishing board	PB for sheathing, t = 12.5; Japanese-style vinyl wallpaper	Cedar plywood laminated jointed-type ceiling	Cypress laminated wood	Cypress laminated wood			
	Washroom	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	Waterproof PB for sheathing, t = 12.5; vinyl wallpaper (anti-mold)	Waterproof PB for sheathing, t = 9.5; vinyl wallpaper (anti-mold)	PVC trim	Ready-made PVC product unless otherwise specified	Washroom counter, L = 1,650; towel hanger; faucet for washing	Pipe fan	
	Lavatory	Floor plywood, t = 12 (structural plywood, t = 28 subflooring)	System material, H = 60	Waterproof PB for sheathing, t = 12.5; vinyl wallpaper (anti-mold)	Waterproof PB for sheathing, t = 9.5; vinyl wallpaper (anti-mold)	PVC trim	Ready-made PVC product unless otherwise specified	Warmed toilet seat; towel hanger; toilet paper holder	Pipe fan	
	Bathroom	Unit bath (1616)								
2F	Hall	Floor plywood, t = 12 (flooring directly on concrete)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified			
	Master bedroom	Floor plywood, t = 12 (flooring directly on concrete)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Storage (middle shelf, upper shelf); curtain rails (double)		
	Western-style room 1	Floor plywood, t = 12 (flooring directly on concrete)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Storage (middle shelf, upper shelf); curtain rails (double)		
	Western-style room 2	Floor plywood, t = 12 (flooring directly on concrete)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Storage (middle shelf, upper shelf); curtain rails (double)		
	Spare room	Floor plywood, t = 12 (flooring directly on concrete)	System material, H = 60	PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified	Curtain rails (double)		
	Lavatory	Floor plywood, t = 12 (flooring directly on concrete)	System material, H = 60	Waterproof PB for sheathing, t = 12.5; vinyl wallpaper (anti-mold)	Waterproof PB for sheathing, t = 9.5; vinyl wallpaper (anti-mold)	PVC trim	Ready-made PVC product unless otherwise specified	Warmed toilet seat; towel hanger; toilet paper holder	Pipe fan	
Common	Stairs	KSA Coordinate Series		PB for sheathing, t = 12.5; vinyl wallpaper	PB for sheathing, t = 9.5; vinyl wallpaper	PVC trim	Ready-made PVC product unless otherwise specified			
	Storage	Plywood form, t = 9		Lauan veneer, t = 5.5	Lauan veneer, t = 4.0	Western hemlock				

4 Results of Case Studies

This chapter presents 27 case studies showing the results of building environmental efficiency (BEE_H) assessments obtained by various types of buildings. Among these case studies, many of the existing buildings have relatively high rankings because they embody a large number of positive environmental features. When assessing an unbuilt home as a model house, features that had already been decided were scored using the planning specifications. However, some features were given a low score because their specific details had not been decided. Relevant cases are presented as "model assessments" in the following list.

For Cases 1 to 8, detailed explanations and a summary of the building specifications are given for each item from Q_H1 to LR_H3, including what specific efforts were made, what issues arose, and how those issues were resolved.

List of case studies

Case 1: House using significant amount of local timber (including timber from FSC-certified forest)
Case 2: Wooden house built using natural materials in a scenic zone
Case 3: Wooden house in an academic city
Case 4: Passive-type wooden house in a quiet urban residential area
Case 5: Weekend house in a suburban area
Case 6: Steel-frame house in a town with abundant greenery, constructed based on the concept of "living close to nature"
Case 7: Light-gauge steel prefabricated house in suburban building lots for sale "model assessments"
Case 8: Wooden house in a suburban area
Case 9: Wooden house that makes effective use of local timber
Case 10: Wooden house built with comprehensive environmental consideration
Case 11: Wooden passive type house constructed in a new town
Case 12: Eco-friendly wooden house
Case 13: Wooden house focusing on basic performance
Case 14: Wooden house to be built in a suburban area "model assessments"
Case 15: Wooden house in an urban area equipped with the latest facilities
Case 16: Wooden house designed with consideration for energy conservation
Case 17: Wooden house in an urban area equipped with the latest facilities
Case 18: Prefabricated steel-frame house built in an eco-friendly town
Case 19: Prefabricated steel-frame house built in a suburban area
Case 20: Prefabricated wooden house to be built on an undetermined construction site "model assessments"
Case 21: Prefabricated steel-frame house built in a suburban area
Case 22: Wooden house built on a site designated for symbiotic housing
Case 23: Prefabricated steel-frame house to be built on an undetermined construction site "model assessments"
Case 24: Eco-friendly prefabricated wooden house to be built in the Tokyo metropolitan area "model assessments"
Case 25: Prefabricated steel-frame house built in a suburban area
Case 26: Wooden house and lot offered for sale, which are at the planning stage
Case 27: Prefabricated steel-frame house built in a suburban area

Case 1: House using significant amount of local timber (including timber from FSC-certified forest)

Overview of building:

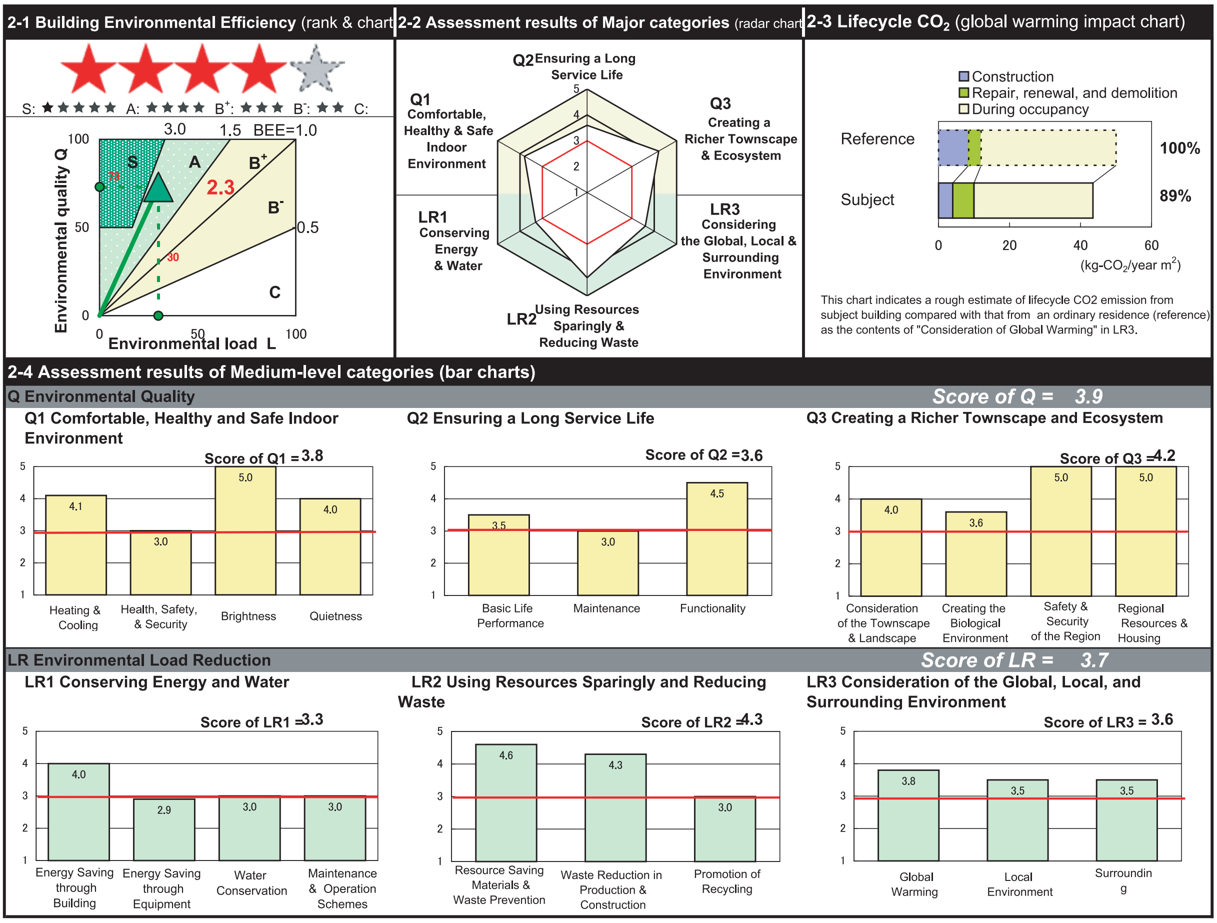
The concept underlying this building is "to create resource-recycling forests and homes." It gives high priority to forest management, so that all structural timber and interior/exterior finish materials come from local forests, including a local Forest Stewardship Council (FSC)-certified forest. Efforts to minimize the house's environmental footprint are not limited to the use of local timber, but extend from the forest to the actual construction site. For example, local FSC-certified timber was processed at a local timber mill and local carpenters built the house using that timber. Consequently, this house has become a model, encouraging a steady increase in the number of environmentally sensitive houses.

Outline of assessment:

Location	Shimokawa Town, Hokkaido
Energy-saving area classification	Zone I
Passive area classification	A
Area/Zone	Outside of City Planning Area
Year and month of completion	March 2006
Site area	434.73 m²
Building area	98.81 m²
Total floor area	136.64 m²
Number of stories	2 stories
Structure and construction	Wood framework method
No. of people in household	5

Implementation of assessment		Assessment date	August 15, 2007
		Stage when evaluated	Occupancy
	Conditions for assessment	Building specifications	Determined
		Site location	Determined
		Home electric appliances brought in	Determined
		Number of people	Determined
		Exterior	Determined

Assessment results:



Considerations and efforts in design

Q_H1: Making the Indoor Environment Comfortable, Healthy, and Safe

The house is located in one of the coldest regions of Hokkaido, so insulation performance was the most important consideration in its design and construction. To secure insulation performance, machine-blown insulation using glass wool (32 kg/m^3, 270 mm in thickness [GW 32 K/270 mm]) was applied to the roof, high-performance GW (24 K/100 mm) and water-repellent GW boards (32 K/45 mm) were used in the walls, vertical insulation on the foundations together with horizontal insulation skirts for the floor, and resin sashes and low-emissivity (low-e) glass layers (containing argon gas) were used for the windows. Although wooden sashes and triple glazing were not used in the window openings because of budget considerations, the next-generation energy-conservation standards were satisfied.

Insulation of roof

Insulation of exterior walls

The heating system uses heating elements under the floor. This allows the whole house to have a uniform temperature and provides a comfortable type of heat. The floor heating system saves space, and is also easy to maintain.

Outlet of underfloor heating

Q_H2: Ensuring Long Service Life

Larch weatherboards were used for the exterior walls and incorporated air vents. The eaves were extended to increase weatherboard life, and the weatherboards can be easily modified or repaired.

The family that lives in the house has a member who uses a wheelchair and auxiliary equipment, so during the design stage they met with the health-care manager to ensure there would be no obstacles for this family member through an appropriate floor plan, elimination of interior differences in level, installation of appropriate handrails, and securing of sufficient space. These steps were taken to help the family member move about the house unaided, and so improve the member's physical condition and reduce the demands on other family members.

Larch planking on exterior walls

Furring strips for ventilation

Q_H3: Creating a Richer Townscape and Ecosystem

This is a farmer's house away from large residential areas. The form and color were chosen so as to harmonize with the surrounding rich, natural landscape.

Embodying efforts to support sustainable forest management, all of the timber used for structural materials and the interior and exterior finish was sourced from a local FSC-certified forest.

Other local materials were also used: *teppeiseki* (pyroxene andesite) stones came from the local area, the tiles were made from local clay, and diatomaceous earth was obtained in Hokkaido.

Siding boards/Diatomaceous earth

Teppeiseki stones

Tiles

LR_H1: Conserving Energy and Water

Insulation meeting the next-generation energy-conservation standards reduced the thermal load of the building. In addition, insulation of the house's foundations and the use of an insulated bathtub secured increased the thermal efficiency of the bathtub.


Foundation insulation


Insulated bathtub

LR_H2: Using Resources Sparingly and Reducing Waste

All structural timber came from the FSC-certified forest in the town. Local timber, including timber from the town's FSC-certified forest, was used for all interior and exterior finish materials as well as materials for the external area.

Also, as part of the efforts to reduce waste in all construction stages, precut timber was used for structural materials, while components produced at zero-emission factories were used for the interior and exterior finish.

FSC-certified timber


Precut timber

LR_H3: Consideration of the Global, Regional, and Surrounding Environment

There is no other residence near the house and no new houses are expected to be built nearby in the future. Therefore, no special efforts were needed to reduce impacts on neighbors.

The site was covered with grass or gravel to allow rainwater to soak into the ground. Preservation of existing trees is also being promoted.

Outline of specifications:

Building frames	Structure		Wood framework construction
	Insulation	Roof	Insulating wool, glass wool (GW) 32 K/270 mm
		Walls	High-performance GW 24 K/100 mm + high-performance water-repellent GW board 32 K/45 mm
		Foundation	Extruded polystyrene foam 53 mm on both sides + insulation skirt
		Windows	Resin sashes + low-e multi-glazed glass (filled with argon gas)
Interior finish	Subfloor	None	
	Interior wall sheathing	Plasterboard 12.5 mm	
	Ceiling sheathing	None	
	Floor finish	Living room, dining room, kitchen (LDK), bedrooms, entrance hall	Three-layer panels (larch) 30 mm
		Japanese-style room	Structural plywood 28 mm + tatami mats
		Western-style room, hall, washroom, lavatory	Structural plywood 28 mm
	Wall finish	LDK, bedrooms, entrance hall, Japanese-style room, hall	Diatomaceous earth
		Western-style room, washroom, lavatory	Structural plywood 12 mm
	Wainscot finish	LDK, bedrooms, entrance hall	Siding boards (larch) 12 mm
	Ceiling finish	LD, bedrooms, entrance hall, Japanese-style room, Western-style room, hall	Siding boards (larch) 12 mm
		Kitchen	Plasterboard 12.5 mm
		Washroom, lavatory	Structural plywood 12 mm
	Stairs		Three-layer panels (larch) 36 mm
Exterior finish	Exterior wall finish		Larch boards 15 mm + protective coating with natural coloring agent
	Roof finish		Long-length colored Galvalume steel plate 0.35 mm
Facilities	Heating		Kerosene-fired boiler + underfloor heating
	Hot-water supply		Kerosene-fired boiler

Case 2: Wooden house built with natural materials in a scenic zone

Outline of building:

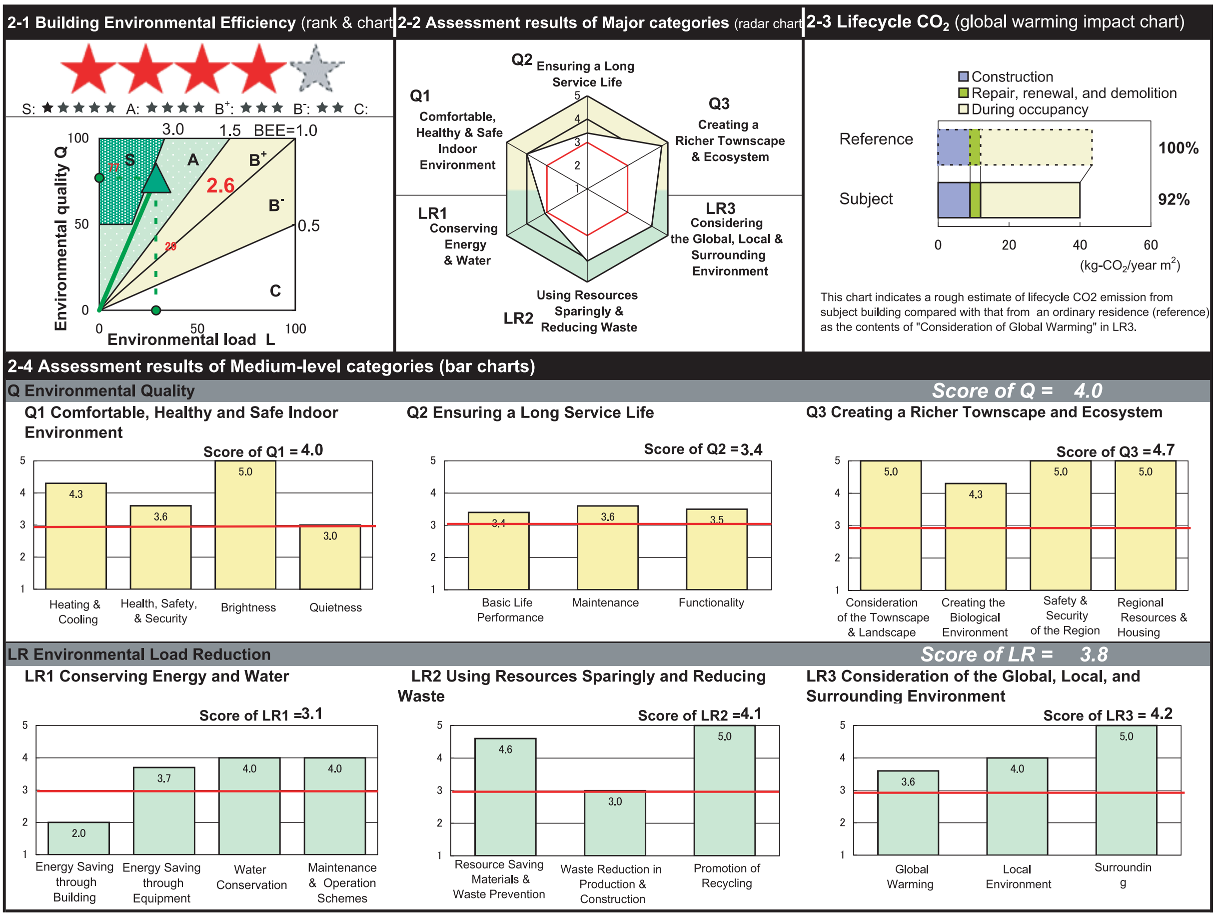
The site is near a temple popular for sightseeing. Nevertheless, it is quiet and has a southeasterly view of the adjacent river and surrounding countryside. The building was designed to make maximum use of the site characteristics provided by differences in elevation, such as natural ventilation and sunshine. Domestic timber was primarily used. In particular, local timber from trees grown in the Kitayama region of Kyoto was used as much as possible. Used materials such as vintage wood, and natural materials posing less risk with regard to disposal, were selected, and craftsmen skilled in traditional building techniques were used to construct the house.

Outline of assessment:

Location	Kyoto City, Kyoto Prefecture
Energy-saving area classification	Zone IV
Passive area classification	C
Area/Zone	Category I exclusively low-story residential zone
Year and month of completion	February 2007
Site area	407 m^2
Building area	85 m^2
Total floor area	133 m^2
Number of stories	2 stories
Structure and construction	Conventional wooden construction
No. of people in household	4

Implementation of assessment		Assessment date	December, 2005
		Stage when evaluated	Occupancy
	Conditions for assessment	Building specifications	Determined
		Site location	Determined
		Home electric appliances brought in	Determined
		Number of people	Determined
		Exterior	Determined

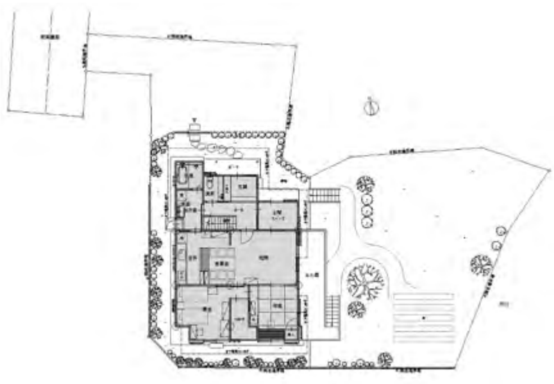
Assessment results:



Considerations and efforts in design

Q_H1: Making the Indoor Environment Comfortable, Healthy, and Safe

The insulation used in the house was assessed as Grade 3 under the Japan Housing Performance Indication Standards. The wonderful site conditions provide plenty of sunshine in winter and considerable airflow in summer. The owner has a philosophy of living in peaceful harmony with nature. As a result, the eves were extended and a semi-external terrace-like space was included to gently separate the "outside" from the "inside" in conjunction with screens made of bamboo, etc. and deciduous trees.



During winter, the 40 mm-thick floorboards made of local timber (Japanese cypress and Japanese cedar) and the interior clay walls store heat that is absorbed from the sunshine allowed to stream into the rooms through large windows; this makes heating equipment for the interior space a supplementary measure. The floor and walls also help regulate humidity and temperature in summer, so the air-conditioning system is used only when elimination of humidity is needed, which is not often. Thus, the air conditioner is almost unnecessary. Natural materials such as Japanese *washi*-style wallpaper were used for interior finish, while persimmon tannin juice and perilla oil were used as coatings.

View from the open veranda

The features of the home's immediate surrounds include the end of the road in front of the house, a parking space shared with the neighboring house, a hedge at the boundary with the road, and no tall fences on borders with adjacent land. Although no special security equipment is installed, the area around the house is covered with gravel that makes a sound when walked on.

Q_H2: Ensuring Long Service Life

The site was developed more than 10 years ago, but the land is weed-covered and an adjacent stream runs three meters below the house. A soil test indicated the existence of cut and banking. Pillar-shape foundation improvement was conducted to homogenize the load-bearing ground (20 kN/m^2) and a mat foundation was adopted. Local timber (Japanese cypress and pine) was used for structural materials. The *shiguchi* (angled joint) technique connects the timbers using a hand-carved mortise and a long tenon locked with a strong pin for security. The interior walls are traditional Japanese plastered walls in which all pillars are visible. Wires and pipes were placed under the floor and outside the house without burying them in the ground as much as possible, to facilitate maintenance. Gently sloping, wide stairs, a barrier-free floor, and sliding doors were adopted as standard, with the main bedroom located on the first floor. However, the assessment of traditional methods was difficult in this case, because materials used for interior and exterior walls are assessed based on ease of replacement rather than ease of maintenance, and clay walls that can be recoated or repaired are not included in standard specifications.

Pillar-shaped improvement pile

Mat foundation

Hand-carved joint

The owner was encouraged to participate in the process of building the house, going to mountain forests and timber dealers to check timber, purchasing desired lights and second-hand fittings, and applying protective oil to the floor and other places. The owner's attachment to the house and the ability to perform simple maintenance without assistance are considered to help give the home a longer life.

Q_H3: Creating a Richer Townscape and Ecosystem

The site was landscaped to a level beyond that of the general area. Old Kitayama logs were obtained for the gate and a hedge that matched the gate was planted, using a greening subsidy from Kyoto Prefecture. The summer camellia is a featured tree of the property, and a lattice-style fence was created along the boundary with neighboring land by planting *kanchiku* (a type of bamboo), camellia, and other trees. About 70% of the site is open space, with a vegetable garden and a grassed area containing flowers and shady trees. At the southern end of the site there is a large Yedo hornbeam tree by the river, in which wild birds build nests. The owner cultivates Japanese orchids as a hobby as well as flowers for the tea ceremony. In addition, the owner uses compost made fron waste for the vegetable garden.

The house is of Japanese style and clay tiles were used for the the general scenic zone. The exterior walls of the first floor were c cedar boards and painted with natural paint.

Sixty percent of the house's timber was sourced from Kyoto Pre nearly 40% came from Mie Prefecture (Owase).

Goldfish pond in the front garden

LR_H1: Conserving Energy and Water

The building is all-electric and equipped with a heat-pump water heater. All the living rooms have sufficient natural light and the indoor environment is heavily influenced by natural ventilation and the heat-storage capacity of the construction materials. When a simulation of the house's electrification was performed, a discussion on power conservation and the energy efficiency of lighting with the owner revealed the owner's in-depth knowledge of natural ventilation and techniques to block the entry of the sun's rays.

The house has a rainwater tank, and there is a stream to the south of the site whose water can be pumped up and used on the vegetable garden, although this is not included in the assessment. It is expected that such criteria will be added to future assessments.

This site is located in a scenic zone where the installation of solar panels is prohibited. The development of materials for use in such conditions, such as low-reflectance panels, is expected.

Wide openings allow natural light to enter

Induction-heater (IH) stoves

Rainwater tank at the corner of the building

LR_H2: Using Resources Sparingly and Reducing Waste

Japanese cypress pillars with a square cross section of 120 mm x 120 mm were used as structural materials, while used logs and domestic pine were adopted for the beams. The use of timber with such large dimensions assumes that it will be reused as building material if the house is demolished in the future. Japanese-style tiles were used for the roof as they are attractive, have good insulation properties, and can be easily maintained, reused, and recycled.

The interior finish uses second-hand fittings and natural materials, including thick boards from coniferous trees. The insulation is a polyester material manufactured from old plastic bottles, which lightens the builders' work and ensures easy recycling when the building is demolished.

Doma-style (earthen, tiled, or stone-paved) floor and recycled fittings

Insulation material on the underside of the roof

Beam made of recycled timber

LR_H3: Consideration of the Global, Regional, and Surrounding Environment

Since this is an area where building sites are large relative to the houses on them and there is no through trafficin the neighborhood, special consideration has not been paid to the adjacent land. However, the outdoor units of the air-conditioning system and water heater are located well away from neighboring houses and surrounded by trees. The property entrance has a low Japanese-style gate that was built to match the surrounding landscape, while the cut stones used for the gate are also recycled.

The site land remains unmodified, except for the area around the house, where it was covered with gravel and soil as before to maintain the water permeability of grassy areas.

Local trees were planted to match the bamboo groves and forests on the mountains that extend to the north.

The life cycle CO_2, estimated using the CASBEE assessment program, is 39.86 kg-CO_2/year m^2.

Approach to the house

Distant view

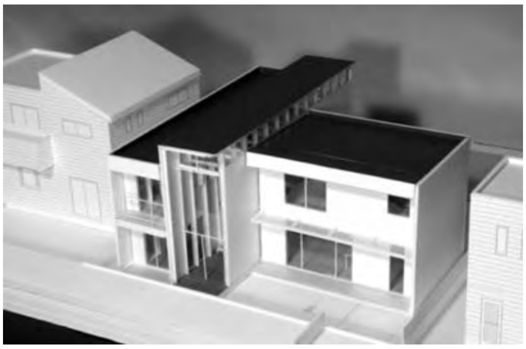
Outline of specifications:

Building frames	Structure			Conventional wood framework construction
	Insulation		Roof	"Perfect Barrier" 50 mm
			Walls	"Perfect Barrier" 50 mm
			Foundation	"Perfect Barrier" 50 mm
			Windows	Aluminum sashes (multi-glazed glass)
Interior finish	Subfloor			Conifer plywood 12 mm
	Interior wall sheathing			Wooden laths 7.5 mm, plasterboard 12.5 mm
	Ceiling sheathing			Plasterboard 9.5 mm
	Floor finish	First floor	Entrance hall, living room, kitchen, bedrooms, lavatory, closet	Flooring of Japanese cypress (40 mm, uncoated timber)
			Japanese-style room	Tatami mats
			Washroom/changing room	Flooring of Japanese oak (15 mm) (uncoated timber)
			Bathroom	Tiles (100 mm square)
			Doma-style (earthen, tiled, or stone-paved) floor	Mortar with brushed finish
		Second floor	Western-style room, corridor, storage room, lavatory	Flooring of Japanese cedar (40 mm) (uncoated timber)
	Wall finish	First floor	Entrance hall, living room, kitchen, Japanese-style room, *doma*-style floor	Clay wall (middle-coat finish)
			Bedrooms	Cypress board (12 mm) + lime plastering
			Lavatory	Cedar board (12 mm) + clay walls (middle-coat finish)
			Washroom/changing room, closet	Cedar board (12 mm) + Japanese-style wallpaper
			Bathroom	Cypress board (12 mm)
		Second floor	Western-style room, corridor	*Tosawashi* (traditional Japanese *washi* paper made in Tosa, Kochi Prefecture)
			Storage room	Cedar board (12 mm)
			Lavatory	Cedar board (12 mm) + *Tosawashi*
	Ceiling finish	First floor	Entrance hall, Japanese-style room, *doma*-style floor	Cedar board (5 mm, 12 mm)
			Bathroom	Cypress board (9 mm)
			Others	*Tosawashi* or Japanese *washi*-style wallpaper
	Stairs			Cypress board (40 mm) (uncoated timber)
Exterior finish	Exterior wall finish			Colored mortar finish (with brushed final coating to make a rough surface)
	Roof finish			*Ibushi* Japanese-style tiles
Facilities	Hot-water supply			Heat-pump water heater
	Air-conditioning system			Air conditioner
	Cooking appliance			IH stove

Case 3: Wooden house in an academic city

Outline of building:

This house was constructed in a residential district containing two universities—one each in the district's eastern and western sides—while the residents enjoy the convenience of good transportation, healthcare, and welfare facilities. The building is divided into eastern and western sections by an area with a doma-style (earthen, tiled, or stone-paved) floor and an open ceiling. This space creates a passive environmental control method, while an active environmental control method, verified by prior simulation, was also included in the design. Together they produce a comfortable indoor environment and reduced energy consumption.

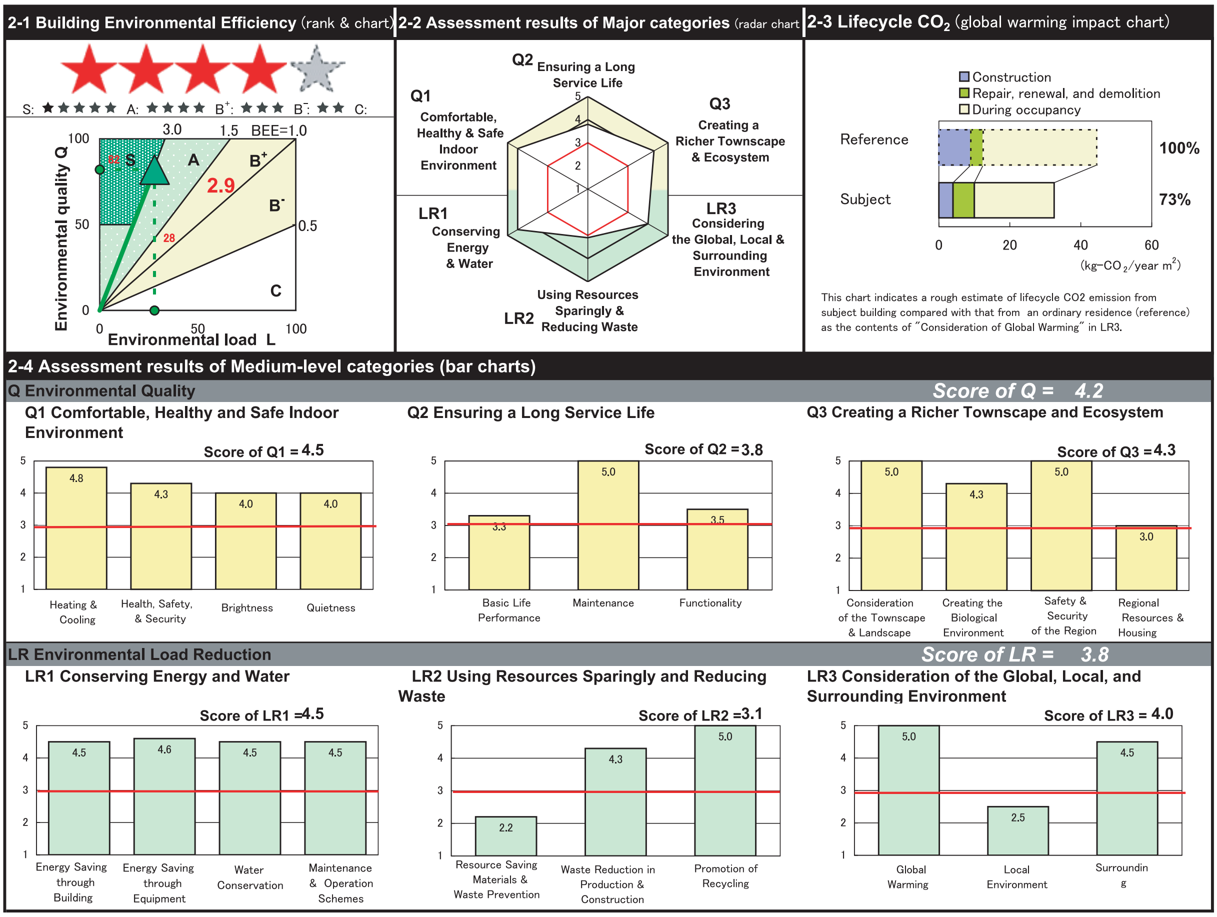


Outline of assessment:

Location	Kitakyushu City, Fukuoka Prefecture
Energy-saving area classification	Zone IV
Passive area classification	C
Area/Zone	Category I exclusively low-story residential zone
Year and month of completion	November 2007
Site area	225.0 m^2
Building area	105.9 m^2
Total floor area	164.0 m^2
Number of stories	2 stories
Structure and construction	Conventional wooden construction
No. of people in household	5

Implementation of assessment	Assessment date		August 17, 2007
	Stage when evaluated		Construction stage
	Conditions for assessment	Building specifications	Determined
		Site location	Determined
		Home electric appliances brought in	Partly determined
		Number of people	Determined
		Exterior	Partly determined

Assessment results:



Considerations and efforts in design

Q_H1: Making the Indoor Environment Comfortable, Healthy, and Safe

Since each living room is connected to the *doma*-style floor space with an open ceiling, it is possible to use passive environmental control selectively and effectively by opening doors as needed. However, heat loss during winter and an increase in the thermal load caused by solar radiation during summer are expected to become problems because of the large *doma*-style floor. Therefore, the building plan was designed to meet the next-generation energy-conservation standards (Q = 2.66 W/m^2•K, É = 0.062 [-]) by installing insulation sashes (double glazing), sufficient insulation material (roof: high-performance glass wool, 16 kg/m^3, 200 mm in thickness [HGW 16 K/200 mm]; walls: HGW 16 K/100 mm; floor: extruded polystyrene foam, 50 mm in thickness), and a large eave designed to blend in with the building around an opening on its southern side. In addition, airtightness was improved by insulating the foundations and installing an air-conditioning system for heating and cooling under the floor to make use of space under the house for transferring heat. To verify the system's performance and determine its specifications, a computational fluid dynamics (CFD) simulation was conducted that confirmed a comfortable indoor environment had been achieved. Figures 1 and 2 show the results of analyses that indicate no temperature variations in the floor surface and a vertical air-temperature difference of no more than about 2℃.

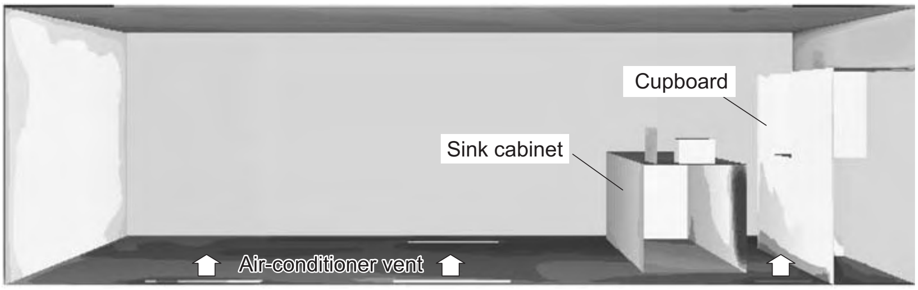


Figure 1 Distribution of surface temperatures in a room while the underfloor heater is operating

Figure 2 Vertical temperature distribution in the living-dining-kitchen areas while the underfloor heater is operating

According to data provided by the Automated Meteorological Data Acquisition System (AMeDAS) of the Japan Meteorological Agency, during spring, autumn, and summer, when natural ventilation is often used in this area, the prevailing wind directions are west to north during the day and southwest to south-southwest during the night. A CFD simulation and a ventilation simulation were performed for these two directions as shown in Figures 3 and 4, to confirm the effectiveness of ventilation and cool storage. A plan that optimized the location and combination of openings was then prepared taking into account the occupants' lifestyles.

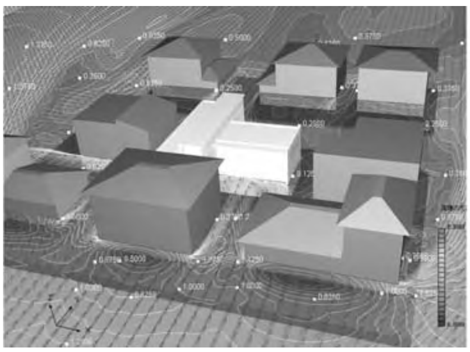


Figure 3 Flow fields and pressure fields around the building (south-southwesterly wind)

Figure 4 Pressure distribution along the southern face of the building (south-southwesterly wind)

In each living room, wood is used extensively in the floor, walls, and ceiling to assist indoor air quality. As anticrime measures, double locks with an auxiliary lock and rain shutters that permit airflow are used for the openings on the first floor.

Q_H2: Ensuring Long Service Life

Since a family comprising three generations is expected to live in this house, sufficient floor area (164 m^2) and storage space (located in the west and north of the house as shown in the floor plans for the first and second floors) were incorporated. Also, an open-plan design was used in part of the house based on assumptions about the family's future lifestyle and the durability of the house. Special doors can be used to control the connection between rooms, thereby creating an open environment for the family as a whole, while maintaining each family member's privacy.

For easy maintenance, many access points were placed in the eastern and western sections to facilitate inspection, cleaning, and repair of the plumbing and underfloor air-conditioning system. A header type water supply was used to allow for the expansion and replacement of pipes.

Q_H3: Creating a Richer Townscape and Ecosystem

The planned house site has a road on its northern side and many detached houses have been built in the vicinity. The adjacent land to the east, west, and south was vacant as of August 2007, but there are plans to build detached houses there. This house has been designed to harmonize with the existing and new houses by setting it well back from the edge of the site and considering the external area, etc. House and site diagrams have already been exchanged with the builders of neighboring houses. Seventy percent or more of the external area will be covered by a garden comprising turf and "Turf Parking" (a product for sustaining and protecting turf) and the planting of two dogwood trees, which are the same type of tree as those along the roadside, in its southern part. Space was allowed in the west of the building for unobtrusive installation of the hot-water storage unit of an "Eco-cute" electric heat-pump type water heater (as shown in the southwestern part of the first floor plan). In addition, an open external area design was adopted to provide emergency evacuation routes and visibility.

LR_H1: Conserving Energy and Water

To increase the efficiency of the passive and active environmental control measures, the quality of the insulation and airtightness needed to be high-meeting the next-generation energy-conservation standards -and energy- and water-conservation equipment was used throughout the house. An air conditioner that functions at 110% or more of the target value in the Top Runner Standard defined in the Act Concerning the Rational Use of Energy was selected for the cooling and heating system. An "Eco-cute" water heater with a COP of 4.9 was selected, and a hot-water storage unit that has a large volume of 370 L but a slim design considering the installation space was adopted. A total heat exchanger with a power consumption of 1.84 kWh/year•(m^3/h) is to be installed. Water-efficient toilet bowls and faucets and a dishwasher will also be installed. An indoor environmental control manual that evaluates lifestyle patterns is provided to the occupants to promote a way of living that conserves energy. Energy conservation "navigation meters" will be installed to show the power consumption of specific activities.

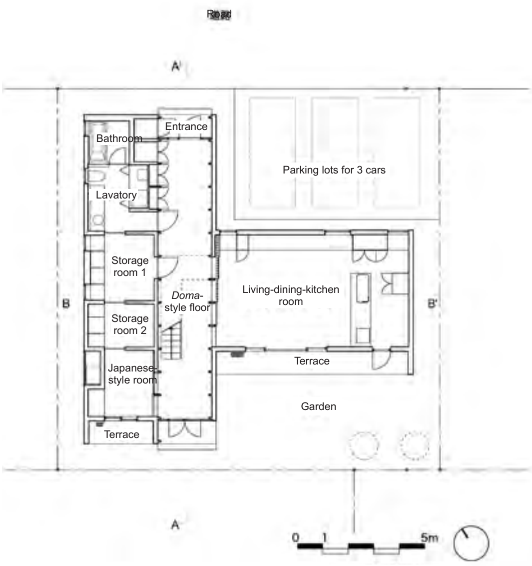
LR_H2: Using Resources Sparingly and Reducing Waste

Recycled and recyclable materials have been incorporated into the design of the building's structure as much as possible. The specifications were decided after providing the occupants with information on the recycling and disposal of building material waste (for example, information on ceramic tiles to be used as flooring in the doma-style floor space). At the production and construction stages, consideration was given to reducing the amount of material lost when timber was precut for the structural frames, and to minimizing waste as represented by using metal forms for the molding materials.

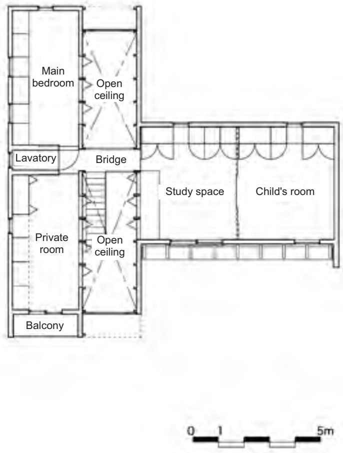
LR_H3: Consideration of the Global, Regional, and Surrounding Environment

The planned site is one lot for sale in a large real-estate development, making it impossible to preserve the existing environmental features. For this reason, the design considered the surrounding environment and local infrastructure. Consequently, the air-conditioning, water-heating, and ventilation equipment operate at low noise/vibration levels, and the locations and exhaust directions of outdoor equipment were decided in relation to the locations of openings in planned neighboring buildings. However, it was difficult to minimize the noise levels of the air-conditioner outdoor units on the eastern and western sides as the available setback distances were as short as one meter from the boundary of the site. It was possible to make 40% of the site open green space and 32% water retention/permeable pavement. In addition, a heat-reflecting sheet with an albedo of about 0.7 covers the roof.

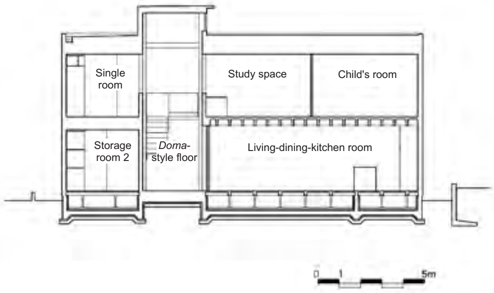
Northern wall of the model house



First floor plan



Second floor plan



Cross section B-B'

Northern wall of the model house

Outline of specifications:

Building frames	Structure		Conventional wooden construction	
	Insulation	Roof	HGW 16 K, t = 100 + 100	
		Walls	HGW 16 K, t = 100	
		Foundation	Extruded polystyrene foam B II, t = 50	
		Windows	Insulated aluminum sash (double glazing)	
Interior finish			*Doma*-style floor	Living room
	Subfloor		Mortar 50, also used for finish	Structural plywood, t = 28
	Floor finish		Ceramic tiles, t = 20	Wooden flooring, t = 15
	Interior wall sheathing		Structural plywood, t = 9	Sheathing plywood, t = 5.5
	Wall finish		Multifunctional calcium silicate board, t = 9.5	Japanese linden plywood, t = 6, butted
	Ceiling sheathing		Ceiling joists 45 x 45 @ 455 lattice	Ceiling joists 45 x 45 @ 455 lattice
	Ceiling finish		Multifunctional calcium silicate board, t = 6	Japanese linden plywood t = 5.5, butted Beams are partly exposed.
	Stairs		Steel stairs	
Exterior finish	Outer wall finish		Plaster coating	
	Roof finish		• Colored Galvalume steel plate, t = 0.35, standing-seam roofing • Polyvinyl chloride roofing, t = 1.5	
Facilities	Hot-water supply		"Eco-cute" (using off-peak power)	
	Cooling and heating		Air conditioner	
	Ventilation system		Heat-exchange ventilation system	
External area	Garden: covered with lawn. Parking space: "Turf Parking." *Inubashiri* (narrow footpath around the house): paved with crushed stone			

Case 4: Passive wooden house in a quiet urban residential area

Outline of building:

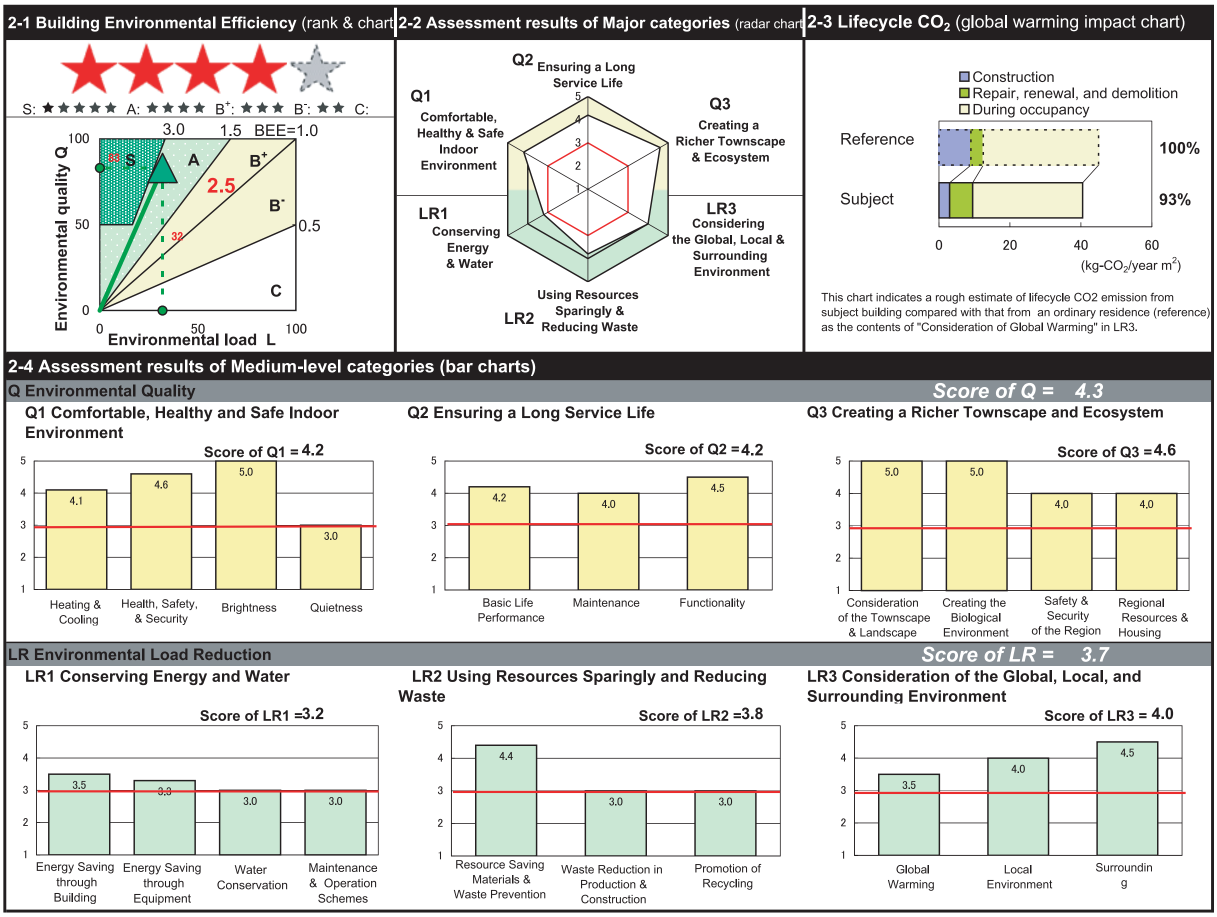
The design of the house gives priority to the passive use of natural energy. Insulation and airtightness were integrated into the doors and windows, which can be fully opened during summer. The minimal use of building materials generating total volatile organic compounds (TVOCs) is aimed at achieving a functional design with high indoor-air quality. Also, the floor plan was prepared considering the three-dimensional flow of air, so windows placed in the ceiling as a skylight can be used to remove heat and stagnant air.

Outline of assessment:

Location	Nerima Ward, Tokyo
Energy-saving area classification	Zone IV
Passive area classification	D
Area/Zone	Category I exclusively low-story residential zone
Year and month of completion	April 2004
Site area	265.61 m²
Building area	76.41 m²
Total floor area	133.69 m²
Number of stories	2 stories
Structure and construction	Wooden framework construction
No. of people in household	6

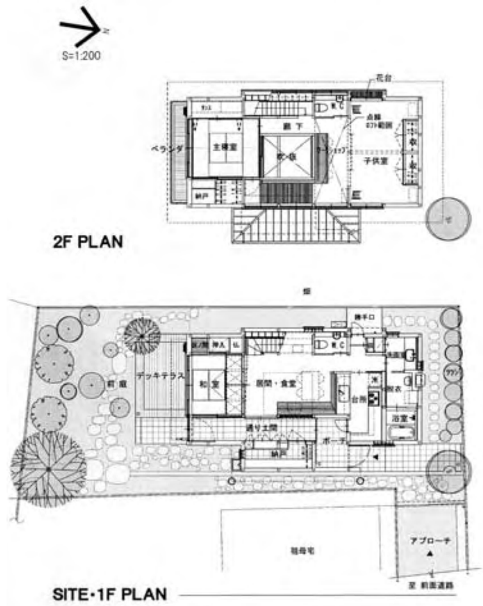
Implementation of assessment		Assessment date	August 15, 2007
		Stage when evaluated	Occupancy
	Conditions for assessment	Building specifications	Determined
		Site location	Determined
		Home electric appliances brought in	Determined
		Number of people	Determined
		Exterior	Determined

Assessment results:



Considerations and efforts in design

Q_H1: Making the Indoor Environment Comfortable, Healthy, and Safe

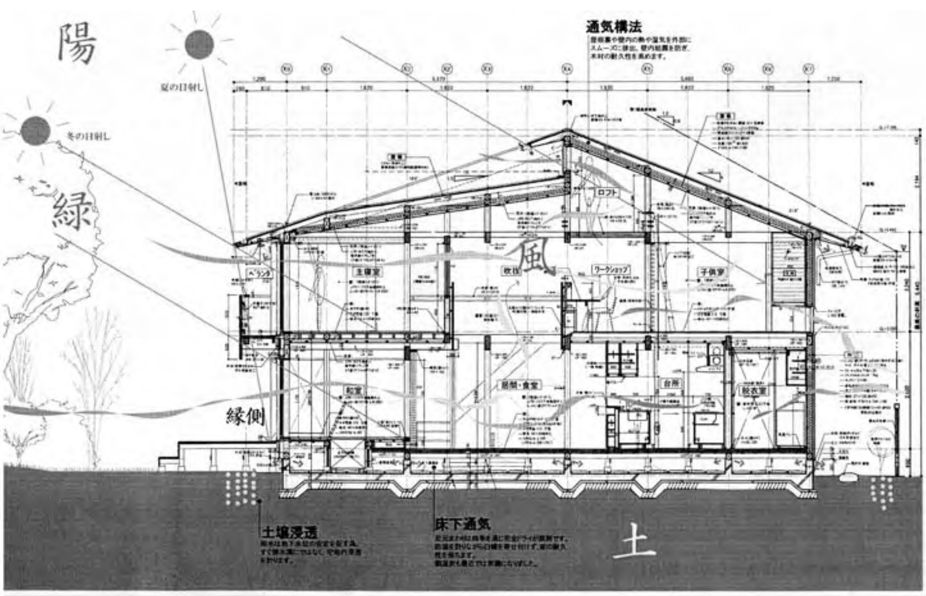


Because of the shape of the building site, the floor plan for the house had to extend from north to south. Thus, light from the southern side of the building in winter was not expected to easily reach deep into the house. The first priority was to make effective use of natural energy as a heat source, so the southern side of the large gable roof was lowered to create high side-window lighting, and this enabled natural light from the southern side of the building to reach far into its northern side. Fortunately, the land adjacent to the west of the house is a field, so as many windows as possible were located on this side of the house to make effective use of the winter sun. The specifications for all these openings only required aluminum sashes and double glazing, as well as wooden lattices, rain shutters, or indoor screens to control the entry of heat and light. The dimensions of the eaves were determined by the height of the openings and the angle of the sun during summer and winter.

Also, to make full use of the ventilation capacity of the openings, the largest possible terrace doors were installed on the southern side of the first and second floors and the windows on the northern side were extended to the floor. The high side window is designed to have the heat discharge function of a monitor roof. With these basic functions secured, the other openings are also able to fulfill their additional function of ventilation.

In summer, wind can be allowed into the house during the night. Therefore, nighttime security measures are important. Rain shutters with air vents can be locked from inside the house and the other openings all have lattices.

If light and wind are regarded as natural energy sources to control the inside temperature, the building materials used in spaces touched by light and wind should also be natural materials, and this standard even extends to coatings such as paint and varnishes. The use of plywood as a sheathing material was avoided, and roughly planed wooden subfloors and wooden laths were used throughout. Although some plywood was used in interior fittings and joinery materials, materials with a rank of F☆☆☆☆and additive-free vegetable oil for staining were required as standard.



Q_H2: Ensuring Long Service Life

It was decided to use a concrete mat foundation after confirming that the ground was stable and supported by the loamy layer of the Kanto region. A point to notice is the arrangement of the house's pipe system. Underground pipes were placed outside the slab in anticipation of future repair and replacement. All sleeves were set vertically at the concrete rises of the foundation, and this piping was left exposed under the floor and was buried in the ground outside the house. While thorough dampproofing measures were implemented around the foundation, charcoal in nonwoven fabric bags was used to cover the underfloor space to further remove moisture. Pieces of Aomori cypress were laid in the ventilation space between the top of the foundation and the sill. All of the pillars on the sills are held in place using the traditional Japanese construction method called *nagahozosashi*, in which the long, straight tenons of the pillars are inserted into the mortises of the sills, fixed by a hardwood pin, and then fastened with metal fittings to satisfy legal requirements. This specification was also applied to all other wood frames, thus ensuring that "wood framed by wood" was included as a standard specification. An attempt to use domestic pine for the horizontal struts was abandoned because of the expense, but 80-year-old Kishuu cedar was able to be used for all pillars. Since the entire framework of the house is considered to be a breathing body, emphasis in the design was placed on exposing the woodwork to the air, and this was achieved by using an exterior ventilation structure and interior traditional Japanese plastered walls in which all pillars are visible. Above all, the primary design policy was that the frame, as the backbone of the building, should give the house a long service life.

Q_H3: Creating a Richer Townscape and Ecosystem

The planned site is land subdivided from an existing house site and ownership has already changed. The site borders on a public road, which runs along the eastern side of the house, but the front of the house cannot be seen from the road because of the shape of the site, which is like a flag flying on a pole with the narrow end of the pole adjacent to the road. However, this site is seen as an extension of the gardens of surrounding residences, and benefits from the established clumps of trees, which are undoubtedly a vital element in creating the landscape. Although the garden was cut off by a visible boundary line, it was intended that the ecosystem of the existing gardens would be integrated into the construction of the house, so the house was planned in such a way that it would not break this link. In addition, a simple gable roof was chosen to match the town's vegetation landscape and harmonize with the surrounding buildings. This site is also a place of coexistence between humans, wild birds, and insects, partly due to the field on the western side of the house. It was strongly felt that the conservation and protection of this rich ecosystem should not be neglected and was a basic condition for creating a good urban habitat.

3

LR_H1: Conserving Energy and Water

A priority in the design was the concept of giving the building an appropriate shape that would make effective use of natural energies, particularly light and wind, without having to use any special machinery and equipment. This passive energy-saving measure is the most important feature of the building, and its shape was determined so as to make this technique work efficiently. Such efforts should be a fundamental aspect of the planning and design of a house. However, a weakness is that the positive effects of such energy-saving efforts have not yet been translated into numerical data. A low score for this house was therefore unavoidable because the CASBEE assessment is based on such data. This weakness is very significant and should be rectified in the future because the passive energy-saving technique reduces the utilization of machinery and equipment installed in a house. Energy-saving appliances for city gas, electricity, and water were adopted as standard equipment of the house. However, they should be given a supplemental role when passive energy-saving measures are adopted. Essentially, the house itself should have a ventilation function; therefore, local mechanical ventilation Class 3 is applied, making the house a spatial device allowing natural ventilation.

LR_H2: Using Resources Sparingly and Reducing Waste

This topic should make us accountable for our use and recycling of natural resources, including the consideration of carbon dioxide emissions, but it is complicated issue to assess. At present, the term "as much

as possible" has to be premised in the measurements for each item. Using this as a basis for assessing a building's structure, which is the major factor influencing the demand for wood, the use of timber from properly managed logging operations was made a standard specification for domestic and imported timber. Consideration was also given to using the most appropriate type of wood for each application to maximize the life of the timber. Measurement and design techniques are extensively sought as a direct anti-waste measure. The amount of waste timber can be reduced by simply starting with a preliminary design and developing it using modules based on the traditional Japanese *shakkan* measurement system so that nonstandard sizes are not generated for the building. Consideration was given to the diversification of commonly used finish materials, as well as the avoidance of secondary processed products of wood. Designs that further reduce the number of installed appliances and equipment, while maintaining usability, will be required in the future.

LR_H3: Consideration of the Global, Regional, and Surrounding Environment

The neighborhood is an old, quiet residential area with a large amount of vegetation. Each block of more than 100 tsubo (approximately 330 m^2) has been subdivided into smaller blocks, but the area and roads still have many shady trees. The priorities for the design were the character of the house and protecting the existing rich vegetation. A general layout was developed that could keep the garden trees intact, and then the house diagram was overlaid onto this. Although some of the trees had to be replanted, all existing trees were transplanted within the site. Because a large chestnut tree stood on the adjoining property to the north, the design attempted to maintain a balance between the house and this chestnut. The color of the building was kept neutral and the natural color of timber was maintained to harmonize the house with the natural "green" color of the town. Equipment was installed so that all sides of the building had a uniform character.

Outline of specifications:

Classification	Item	Floor	Rooms where products used	Products
Interior finis	Floor materials	1F	Porch, *doma*-style floor entrance, storage room	"Soil ceramic tiles," □300 x 20 EXTERIOR Series
			Living rooms, kitchen, lavatory, washroom, changing room	Ash unprocessed flooring, t = 15 x 90 (wiped with perilla oil)
			Bathroom	Stoneware □200 tiles
			Japanese-style room	Tatami mats, t = 60
		2F	Main bedroom	Tatami mats, t = 60
			Work room, children's room, corridor, lavatory	Cedar unprocessed flooring, t = 15 x 90 (wiped with perilla oil)
			Wooden deck	Western hemlock, 40 x 90 (with protective coating)
			Loft	Western hemlock, 40 x 105 (with protective coating)
	Wall materials	1F	Porch, *doma*-style floor entrance, storage room, living room, dining room, Japanese-style room, stairs	Coating of lime with silica sand
			Lavatory, washroom, changing room	Waterproof board as sheathing, coating of lime with silica sand
			Kitchen	Waterproof board as sheathing; EP coating; partly, "meijikesho" fireproof board
			Bathroom	Porcelain □100 tiles
		2F	Main bedroom, children's room, corridor, work room, wooden deck, loft	Coating of lime with silica sand
			Lavatory	Waterproof board as sheathing, coating of lime with silica sand
	Ceiling materials	1F	Porch, *doma*-style floor entrance	Second floor, Japanese hemlock 40 x 90 drain board floor, protective coating
			Storage room, living room, kitchen, Japanese-style room, stairs, kitchen, lavatory, washroom, changing room	Plasterboard, t = 9.5; *kanreisha* (special cloth for undercoating use) treated with putty; EP coating
			Bathroom	Japanese cypress, t = 12 x w = 100
		2F	Main bedroom, work room, children's room, corridor, wooden deck, loft	Plasterboard, t = 9.5; kanreisha cloth treated with putty; EP coating

	Parts	Bed	Products
Exterior finish	Roof	Rafter + sheathing roof board + asphalt roofing Wooden sheathing	"Taima Color" (Galvalume steel plate)
	Eave soffits	Wooden laths + asphalt roofing + mortar finish	Calcium silicate board, VP coating
	Exterior walls	on metal laths Wooden subfloor	Lime coating/"Tana Cream"
	Deck	Exposed concrete finish	Canadian cedar (protective coating)
	Foundation	Processed composite panels	Mortar with brushed finish
	Eaves troughs	-	Roofing + folded stainless steel
	Rainwater guttering	-	Rigid PVC pipe, UP coating
	Fitting	-	Aluminum sashes (6 + 6 + 6, double glazing), all wooden fittings
	Lattice		Canadian cedar (protective coating)
	Insulation/ moisture-absorbing material	-	Glass wool 24 kg/m^3 and 16 kg/m^3, polystyrene foam beads/underfloor moisture-absorbing carbon (to create comfortable living environment)

Case 5: Weekend house in a suburban area

Outline of building:

This house is located amidst farmland in northern Saitama Prefecture. It is a weekend house constructed on a large site of more than 300 *tsubo* (approximately 990 m²) with shrubs, a bamboo grove, and a water channel around its perimeter. Half of the house itself is set on a platform that is one meter higher than the surrounding ground, while the remainder is built with its floor elevated above ground level. This platform was kept after a house from the Edo Period (1603-1867) was demolished 10 years before because the owner decided to leave a reminder of the previous building, but it was strengthened for the construction of the new house.

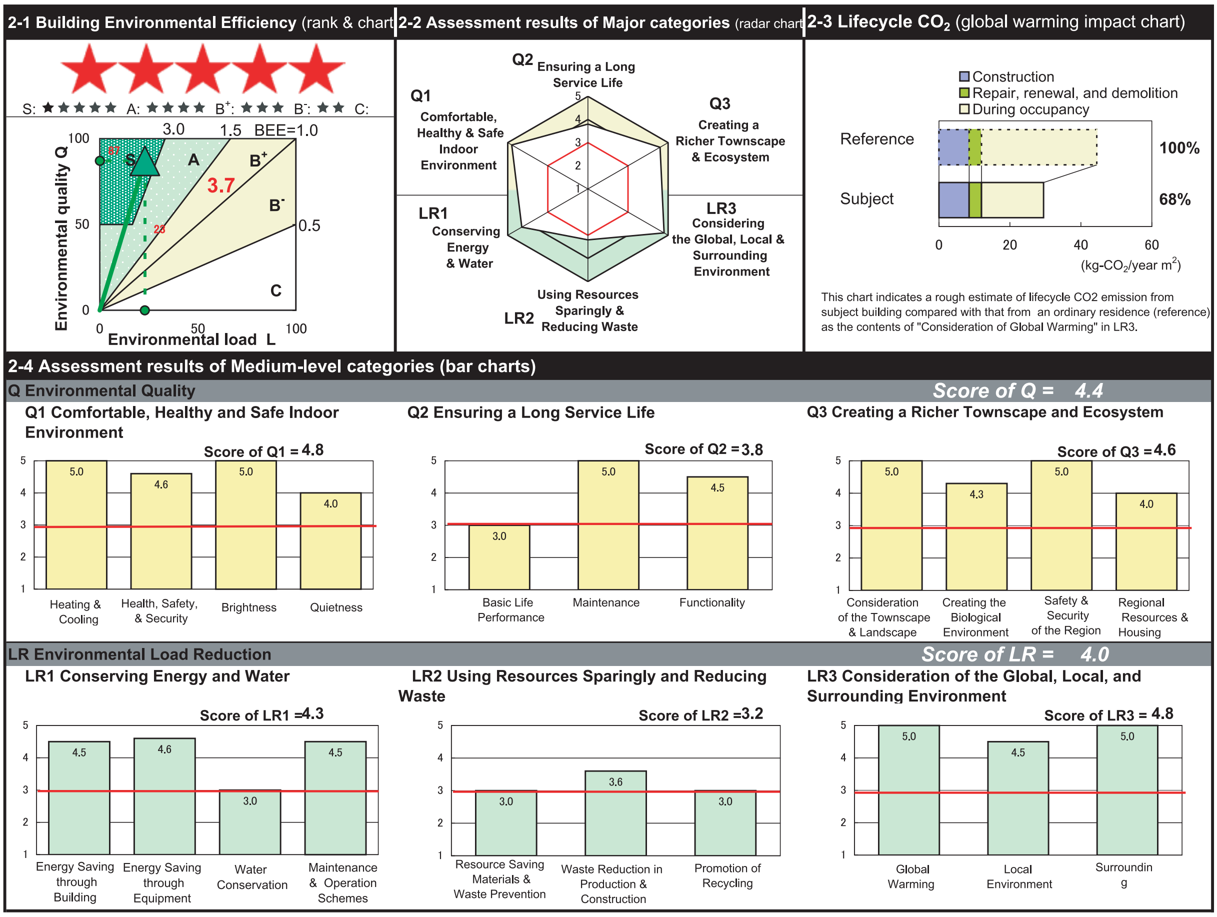
Outline of assessment:

Location	Saitama Prefecture
Energy-saving area classification	Zone IV
Passive area classification	D
Area/Zone	Non-designated area
Year and month of completion	August 2006
Site area	977.6 m²
Building area	81.9 m²
Total floor area	84.0 m²
Number of stories	2 stories
Structure and construction	Conventional frame construction
No. of people in household	2

Implementation of assessment	Assessment date		August 26, 2006
	Stage when evaluated		After completion
	Conditions for assessment	Building specifications	Determined
		Site location	Determined
		Home electric appliances brought in	-
		Number of people	Determined
		Exterior	Determined

3

Assessment results:

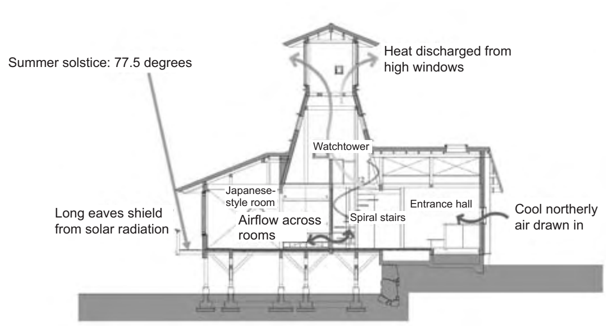


Considerations and attempts in design:

Q_H1: Making the Indoor Environment Comfortable, Healthy, and Safe

Good insulation and airtightness enhance the durability of the building frame, and are regarded as prerequisites for energy conservation measures to reduce heating and cooling demands. Thus, the next-generation energy-conservation standards of performance are secured. The area of sashes used in door and window openings was maximized to so that the northern garden on the platform and the large southern garden could both be seen from the central living room. Wooden insulation sashes with a heat transmission coefficient of 2.80 W/m^2 K were used to reduce the thermal load of these large sashes. As a security measure, crime-prevention architectural component ("CP") type security glass and a double-locking mechanism were installed in the main door.

Winds from the south and east predominate during summer, and northwest winds predominate from autumn to spring in this area. Thus, windows were located so that comfortable seasonal winds can easily enter the house. Also, it was possible to create paths for the wind that readily allowed the airflow to pass through the rooms by installing movable fittings and long-length windows under the stairs, as well as sashes that can be safely opened during the night. The shape of the watchtower, which is a feature of this building, is useful for natural ventilation because it takes advantage of the vertical temperature (and pressure) variations. Opening the windows of the watchtower on hot and humid days allows heat and warm air to leave and indoor air to rise from the ground level, creating a negative pressure and drawing in outside air. Therefore, if windows on the north side or lower part of the house are kept wide open, cool air will enter, ensuring that on hot summer days the occupants can pass time comfortably inside from the morning to early afternoon.



■ North-south cross-section: S = 1/100

Much consideration was also given to indoor air quality. Building materials were selected that were of F☆☆☆☆ rank for formaldehyde or did not contain any formaldehyde, and it was also confirmed using Material Safety Data Sheets (MSDS) that they did not contain any of 12 other substances for which indoor concentration guideline values have been defined by the Ministry of Health, Labour and Welfare. Of these 13 substances, particularly hazardous materials such as toluene and xylene are generally contained in adhesives and paints. Therefore, in principle, the use of adhesives was avoided as much as possible in the construction process. For example, nails and adhesives are generally used in building floors, but only screws were used in this case.

Q_H2: Ensuring Long Service Life

A soil survey was performed before decisions were made on the unique foundation composition and style, in conjunction with a structural designer. Specifically, the style of the foundation differs between the upper and lower levels of the earth platform. That on the lower level binds independent foundations using underground beams, while the upper level has a concrete mat foundation. The wooden structure built on the foundations employed traditional framework construction with 120 mm-square pillars, and the skills of local carpenters were fully utilized in the processing of connections and joints. The combination of transverse beams, longitudinal beams, cogged joints, center joints, and dovetail joints produced a beautiful, robust, and resilient structure.

The prevention of internal moisture condensation was important to ensure that the wooden frame would have high durability, so specific measures were taken including underfloor ventilation, a ventilated-air layer inside the exterior walls, continuous insulation partitions, and the installation of moisture-proof sheets in the exterior walls. In cases where braces or an electricity distribution box are located in a complicated manner, insulation can be blown in to fill the space between the exterior and interior walls. This method was used because, although it is costly, it was judged to be worth the expense in consideration of long-term durability due to its high reliability.

To assist in maintenance, the water supply and sewerage pipes as well as the main electricity cables were not buried in concrete, and inspection holes were located as necessary. Header piping was used for water and hot-water supply to facilitate future extension. After completion of the building, a manual on living in the house was prepared to provide information on design objectives, airflow/ventilation, usability, and maintenance procedures.


Q_H3: Creating a Richer Townscape and Ecosystem

There is no other building in the area with a watchtower. The location of the site, which is not a high-density residential area, imposed few limitations on the shape of the building and made an unrestricted design possible. Nevertheless, the house matches the surrounding buildings because the depth of its eaves (900-1,000 mm), the color of the exterior finish, and the pitch of the roofs of neighboring homes were all considered in the design, and materials subject to age deterioration were used. The watchtower is an integrated response to the desire of the owner for a private space in an elevated place to read books, the need for indoor climate control, and landscape design.

Although preference was given to local timber, Douglas fir with its structural toughness was used for transverse and longitudinal beams, while cedar was used for the pillars. However, Japanese cypress from Saitama Prefecture was used for the diagonal braces and struts that support the sill and floor.

LR_H1: Conserving Energy and Water

In addition to passive energy-saving measures to reduce the thermal load, active measures were employed such as the use of energy-saving equipment and the installation of solar power panels producing 1.8 kW of electricity to make use of an average of more than 200 hours of sunlight per month during winter. These helped to create a house in which people can live without depending heavily on fossil fuels.

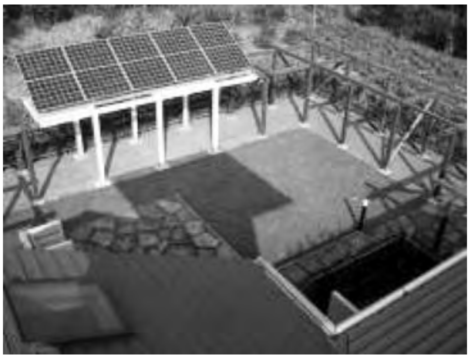
A heat-pump water heater (coefficient of performance [COP]: 4.55) using a natural refrigerant (CO_2) was selected because it had the highest energy-conservation rating of electric water heaters used at that time. This heater, made of stainless steel, is durable, sanitary, and equipped with a 370-liter hot-water storage tank. Warm white fluorescent lights were chosen for light fixtures as much as possible. In places such as the exterior or the watchtower, where bulb replacement is not easy, bulbs with a longer life were used.


LR_H2: Using Resources Sparingly and Reducing Waste

Insulation made from recycled PET bottles was adopted for exterior use. Standardization during the material production stage to reduce waste was not introduced other than the 910 module (910 mm) used for conventional construction. Thus, efforts were not actively made to reduce the generation of byproducts. However, data and an explanation encouraging recycling were offered to the builders at the building site before construction commenced. Also, materials used in the house were listed in the manual on living in the house provided to the owner, although information on recycling and disposal of used materials has yet to be given and remains an issue to be solved.

LR$_{H}$3: Consideration of the Global, Regional, and Surrounding Environment

The building site is located in an area that has a history dating back to the Edo Period and some of the trees in the garden are more than 100 years old. Therefore, existing trees were preserved as much as possible and a variety of new trees were selected for planting. A horseshoe-shaped pergola, where climbing plants (such as climbing roses and trumpet creepers) are to be planted, was placed in the north garden on the earth platform. The combination of new shade trees around the pergola, the existing trees, and a water feature will create a new cool area around the house that generates a milder climate in which the occupants will be able to enjoy a healthy and comfortable life in concert with the changing seasons.



Outline of specifications:

Classification	Item		Products	
			Room	Names of products
Interior finish	Floor materials		Entrance	*Teppeiseki* stones
			First floor	Cypress floor board 15 mm
			Second floor	Nanba larch panels 36 mm
	Protective coating for wood		Floor/pillars	Unbleached beeswax
	Stairs	Glued laminated wood of Japanese cedar	Stairs	Larch panels
	Tatami mats	Rush mats	Japanese-style room	"Yasuragibingo" rush mats
	Plastering material		Entrance hall, Japanese-style room	"Nakakirishima Wall" SN2
			Living room, dining room	"Nakakirishima Wall" SN4
	Japanese washi paper		Japanese-style room	"Kurokaji-junkozoshi" SA-03
			Second floor	"Yake-iri-junkozoshi" SA-04
	Paint		Washroom, lavatory	
	Tiles	Wall tiles	Kitchen	FOBW-100NET/3
		Joints	Kitchen	"Superclean Kitchen" SK-22 (gray)
		Wall tiles	Washroom	"Interior Mosaic Shirishia" IM-50P1/CK1B
		Joints	Washroom	"Superclean Bath/Toilet" SS-11K (white)
		Wall tiles	Bathroom	100 mm square M02
		Wall joints	Bathroom	"Superclean Bath/Toilet SS-11K" (white)
		Wall tiles	Bathroom	"Thermotile Slate" ST-33 300 mm square
		Floor joints	Bathroom	"Superclean Bath/Toilet" SS-23K (dark gray)
Sheathing material	Sheathing roof boards			Cedar finished sheathing roof board 12 mm
Functional materials for finishes	Adhesive for floor		-	Not used due to nailing
	Adhesive for tiles		Entrance floor, bathroom floor	Mortar
			Kitchen walls, washroom walls, bathroom walls	A-51N
	Adhesive for Japanese *washi* paper		Entrance, Japanese-style room, dining room, etc.	"Harebare" (starch-based glue)
Fittings	Interior doors	Surface material	Lavatory, washroom, etc.	Birch plywood
		Adhesive		New CH18
		Coating		Unbleached beeswax
	Paper sliding doors	Surface materials	Japanese-style room	"Asagami" SA-09 (hemp paper), partly "Junkozoshi" SA-07 (Japanese *washi* paper made from paper mulberry containing persimmon tannin)
		Adhesive		"Harebare"
Other functional materials	Urethane coating		Kitchen counter, living room table	"Aqurex Flat" urethane for wood
	Coating for spiral staircase and steel pillars of entrance		Entrance, hall	"Audecoat G Eco", Japan Paint Manufacturers Association, Edition A, 2001, A22-85B (cream-white color) half gloss
	Caulking compound for sashes			PS sealing
	Anti-termite treatment	Cedar oil + wood vinegar	Underfloor	Cedar oil + wood vinegar
	Coating for exterior wood		Timber deck, eave soffits, etc.	"Wood Long-Eco"
	Coating for exterior steel	Undercoating	Pergola	Water-based "Haibon Primer"
		Finish coating		Water-based "Fine Urethane" U100
	Insulation material		Ceilings, floors	"Neoma Foam"
			Walls	"Perfect Barrier", blown
Exterior finish	Diatomaceous earth coating		Exterior walls	"Keisoutica" (diatomaceous earth) 109, P, roughly brushed finish

Case 6: Steel-frame house in a town with abundant greenery, constructed based on the concept of "living close to nature"

Outline of building:

The site is in a large-scale residential area developed on reclaimed land. The development was scheduled to have 1,500 detached houses and condominiums. One of the development concepts for this area is symbiosis with the natural environment, and the appearance of the town shows an abundance of vegetation and integrated house facades. The house evaluated here is a prefabricated house completed in 2005, and was assessed one and a half years after a four-member family began living in it. Because it is a prefabricated house, this is a case where an assessment was conducted after all building conditions were determined without any discussion with the prospective occupants at the design stage.

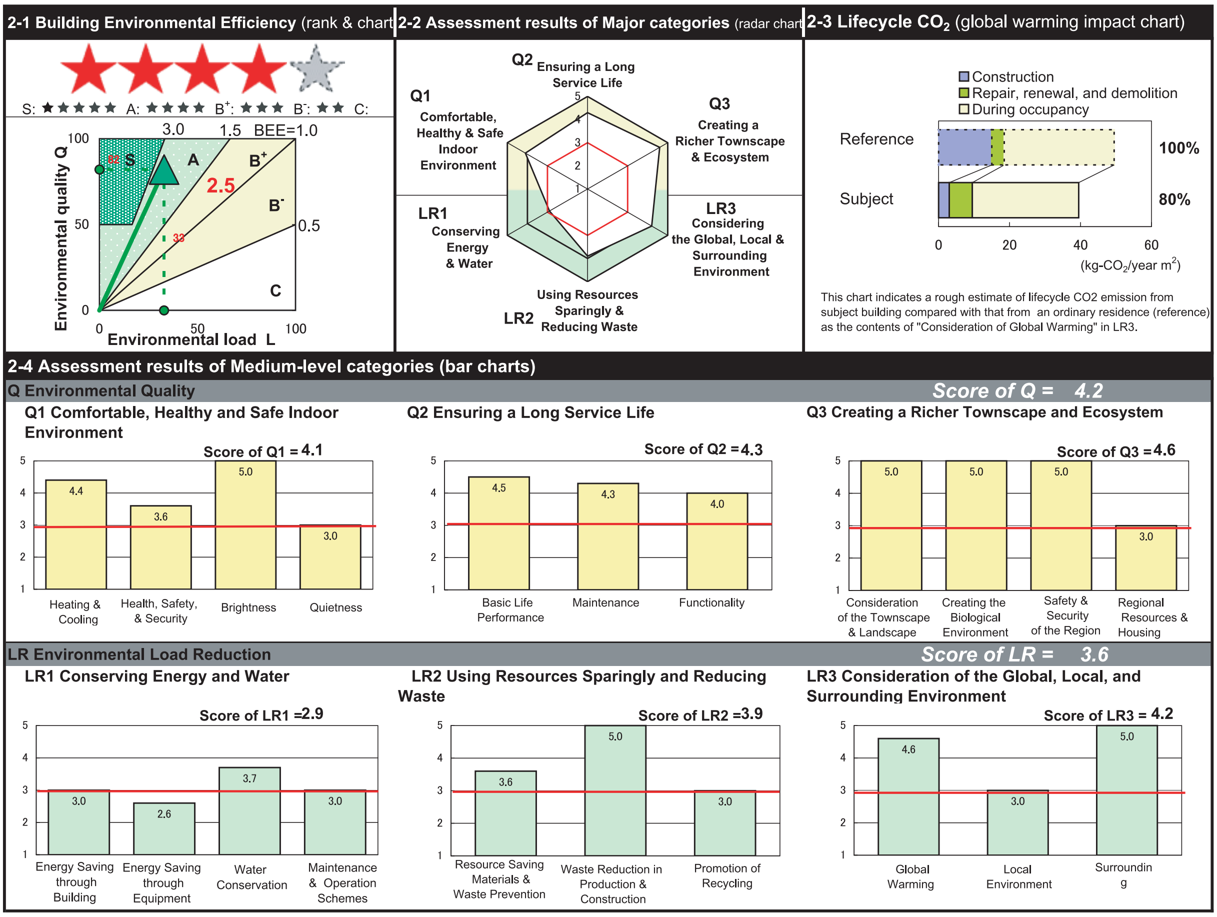
Outline of assessment:

Location	Fukuoka Prefecture
Energy-saving area classification	Zone IV
Passive area classification	C
Area/Zone	Category II residential zone
Year and month of completion	September 2005
Site area	211.9 m^2
Building area	71.61 m^2
Total floor area	134.38 m^2
Number of stories	2 stories
Structure and construction	Light-gauge steel construction
No. of people in household	4

Implementation of assessment		Assessment date	
		Stage when evaluated	After completion
	Conditions for assessment	Building specifications	Determined
		Site location	Determined
		Home electric appliances brought in	Determined
		Number of people	Determined
		Exterior	Determined

3

Assessment results:



Considerations and attempts in design:

Q_H1: Making the Indoor Environment Comfortable, Healthy, and Safe

Insulation meeting the next-generation energy-conservation standards was installed to provide a comfortable internal atmosphere. Double glazing with heat shielding and heat insulation was used in the windows to reflect solar radiation during the summer. Although the natural ventilation was only assessed as Level 1 because openings could not be placed in two directions in a second-floor bedroom, most rooms have windows in two directions for natural lighting and ventilation. Air conditioners brought in by the occupants are used for heating and cooling. They are old models, but satisfy the heating and cooling needs of each room and are installed in appropriate positions for the shape of the room or residential area, so were given an assessment of Level 5.

To avoid chemical pollutants, building materials of F☆☆☆☆ rank with the minimum release of formaldehyde were used for the interior finish, formaldehyde-free wallpaper adhesive was used for the ceilings and walls, and building materials of F☆☆☆ rank or above were used for the interior fittings.

Anticrime measures were assessed as Level 3 because all openings were equipped with two locks in different places to prevent intrusion. However, this residential area supports "town security" and operates a high-level anticrime system that includes the installation of security cameras and 24-hour routine patrols by security guards.

To ensure sufficient light in the rooms, simple opening ratios of 20% or above were required. In particular, a large opening in the southern wall of the building, which faces a garden, is part of the plan to make active use of daylight.

Q_H2: Ensuring Long Service Life

The steel components of the house frame had three layers of rustproofing to ensure high durability. Exterior wall materials and roof materials were installed using original metal fittings, to avoid damage to the sheathings at the time of repair or replacement. A header piping system for water supply and drainage facilitates replacement, and prepares for any future installation of new equipment.

The earthquake resistance of the house was assessed as Grade 3 under the Japan Housing Performance Indication Standards because of the original frame construction. The house's total floor area of 134 m^2 is normal for a four-member family and a 5LDK (5 bedrooms and living-dining-kitchen area) floor plan. The second floor was planned as a private area with four private rooms and the first floor was planned so as to be used as an entertainment area for the family or visitors by making the LDK area and the adjacent Japanese-style room available as an integrated large open space.

Q_H3: Creating a Richer Townscape and Ecosystem

This residential district was developed on vacant reclaimed land, and the town has been built from scratch with an eye to the harmony of all its buildings. For example, uniformity is ensured throughout the town by using the same kind of local stone for the exterior stone fences of all houses.

The western side of the house site adjoins a 5.5-meter road, while on the other sides are sites where detached houses of the same size will be built. On the site boundary with the street, medium-height and tall trees are planted with basic low hedges so as not to make the site a closed space while giving variety to the street.

Similarly, medium-height trees and tall trees are planted with basic hedges about 1,500 mm high to maintain privacy.

The site area of 212 m^2 and building coverage ratio of 34% produced a rather large garden for a Japanese detached house. Active greening of the garden and the construction of a garage resulted in a 107% ratio of green coverage relative to the site area (the calculation is described in "Q_H3.2.1 Greening of the premises").

Consideration was also given to the local ecosystem by selecting trees suited to the local climate and creating living habitats for small animals and plants by generating smaller spaces among the stonework and hedges.

LR_H1: Conserving Energy and Water

To reduce energy demand for heating and cooling, insulation that meets the next-generation energy-conservation standards is used. However, the air conditioners brought in by the occupants were old models and their ability to confirm with the energy-saving standard achievement rate laid down in the Act Concerning the Rational Use of Energy was unknown, resulting in an assessment of Level 1.

A high-efficiency latent-heat-recovery water heater was installed to save energy. To reduce energy use by lighting, electric appliances, and kitchen equipment, energy-saving lightbulbs, electric toilet seats, and gas cooking stoves were installed as standard equipment before the house was put on the market, but the current next-generation energy-conservation standards cannot evaluate them so an assessment of Level 1 was given. In addition, hybrid ventilation, i.e., ventilation by temperature differentials, was employed to save energy. To conserve water, water-efficient toilets and a dishwasher were installed.

Installation of the above equipment can be considered as providing an energy-saving infrastructure. However, the appropriate use of this equipment and the lifestyles of the occupants are important to gain the maximum energy-saving effects. To communicate such information to the occupants, they were provided with a manual containing instructions for the use of each appliance and advice on appropriate lifestyles in the house.

LR_H2: Using Resources Sparingly and Reducing Waste

Some of the components used in the building come from recycled materials. For example, the basic material of the roof tiles and exterior wall panels contains a raw material extracted from waste timber offcuts, the insulating glass wool contains raw materials derived from products collected on the site, and the plasterboard contains raw materials made from wastes generated by other industries.

Wastes generated on the building site were separated into 27 categories and then separated into more than 60 categories in the factory so they could be reused. The establishment of a resource recycling system based on consistent production systems enables efficient recycling.

LR_H3: Consideration of the Global, Regional, and Surrounding Environment

The results of the global warming assessment were not good because this is an existing house, and current energy-saving standards do not evaluate equipment installed in existing houses. However, the global warming effect chart shows that the extended life of the building greatly reduces CO_2 emissions during the "Construction" stage.

Protection of the land's form, surface soil, and existing trees was impossible because the building site was located on newly reclaimed land, but the planting of local trees embodied consideration for the local natural environment.

In principle, the appropriate location of appliance outlets could reduce the effects of noise and exhaust gas on the neighborhood because the site is sufficiently large. However, the effect of exhaust gas from combustion appliances was reduced as much as possible by planting trees at least 1.5 m high among the hedges.

Minimizing the area of concrete that prevents rainwater infiltration and placing medium-height and tall trees so as to overlap the shrubs are effective measures to not only limit increases in soil surface temperatures during the summer season, but also to create a comfortable thermal environment close to the ground.

Case 7: Light-gauge steel prefabricated house in suburban building lots for sale (model assessment)

Outline of building:

This case assesses the model plan of a light-gauge steel prefabricated house.

The assessment was performed for the case of standard specifications of a house in which optional facilities were not installed. It was assumed that air conditioners and other home electric appliances to be brought in by the occupants had not been installed.

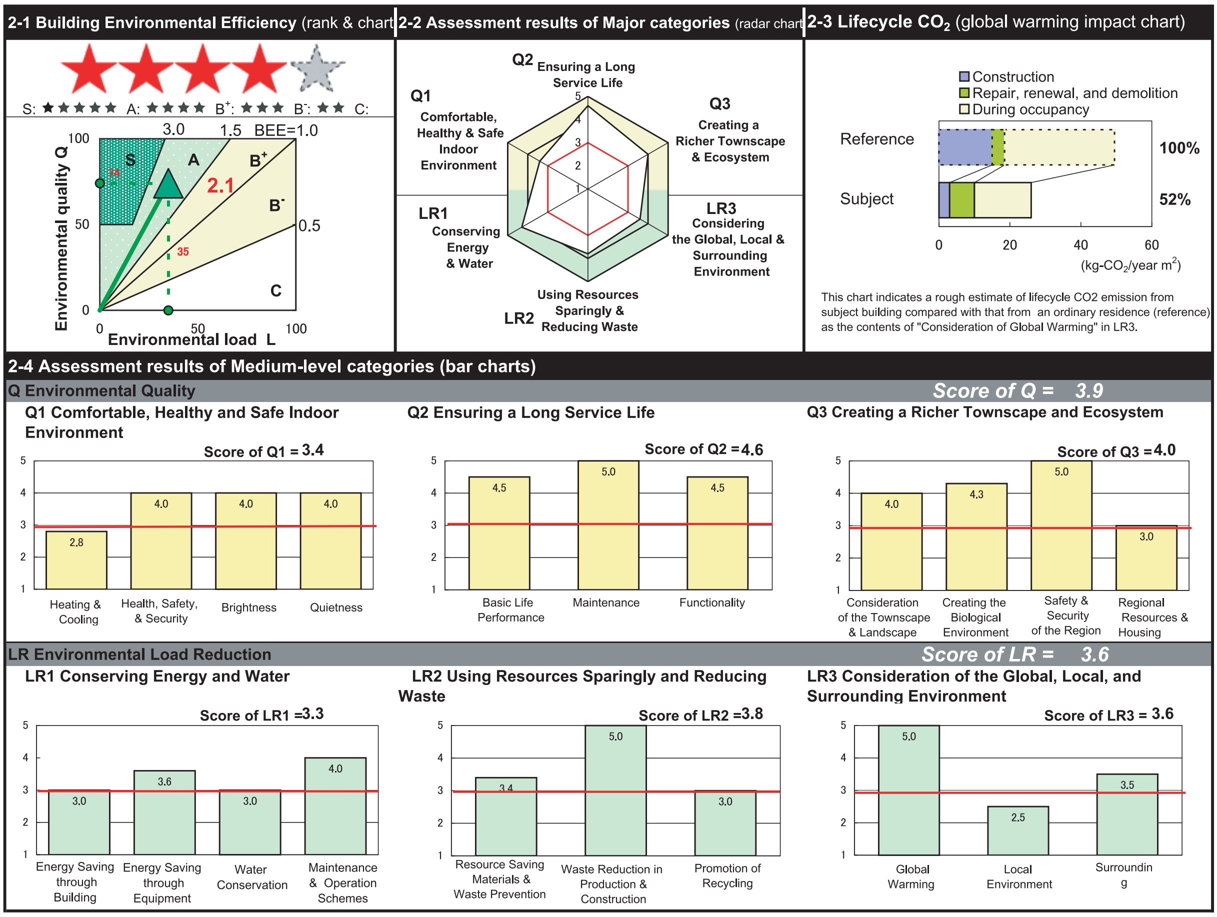
The planned site is a building lot for sale in Ichihara City, Chiba Prefecture. The design of the home's exterior was planned with consideration for the creation of a pleasant town with substantial greenery.

Outline of assessment:

Location	Ichihara, Chiba Prefecture
Energy-saving area classification	Zone IV
Passive area classification	D
Area/Zone	Category I residential zone
Year and month of completion	–
Site area	205 m2
Building area	91 m2
Total floor area	157 m2
Number of stories	2 stories above ground
Structure and construction	Light-gauge steel
No. of people in household	4

Implementation of assessment	Assessment date		March 13, 2007
	Stage when evaluated		Assumed
	Conditions for assessment	Building specifications	Assumed
		Site location	Assumed
		Home electric appliances brought in	Assumed
		Number of people	Assumed
		Exterior	Assumed

Assessment results:



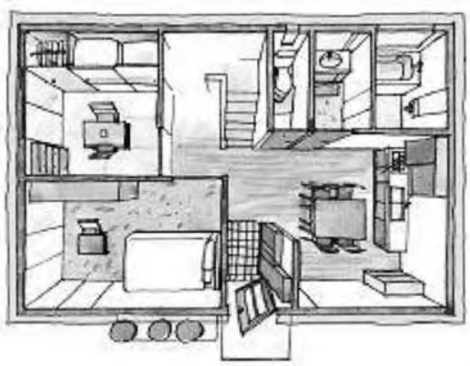
Considerations and attempts in design:

Q_H1: Making the Indoor Environment Comfortable, Healthy, and Safe

The strict insulation specifications include the thermal insulation outer wall with air layer to improve the basic ability of the building to handle heat and cold (Grade 4 assessment under the Energy-Saving Action Grades in the Japan Housing Performance Indication Standards).

The heat insulation method used for the exterior walls creates an air layer in the wall and so helps improve the amenity by decreasing the heat bridge effect and preventing moisture condensation in the wall.

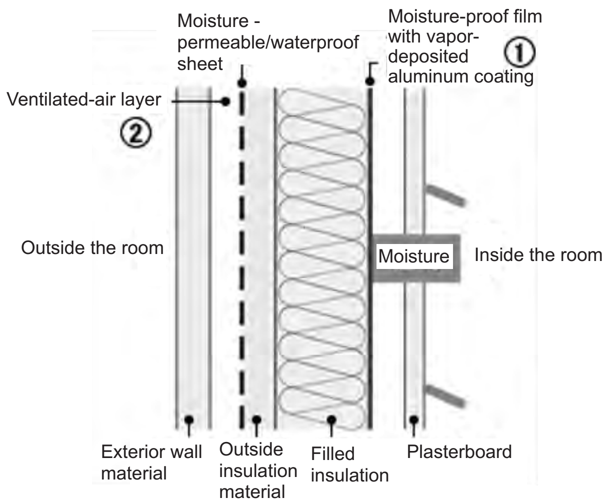
Bringing in outside air and discharging heat are effective ways to deal with heat during summer. However, windows in the first floor living room were only placed on one side, making the removal of heat difficult. When considered in conjunction with the lack of an air-conditioning system, this resulted in a low value for "Heating and Cooling."



A layer of insulation material envelops the entire house.

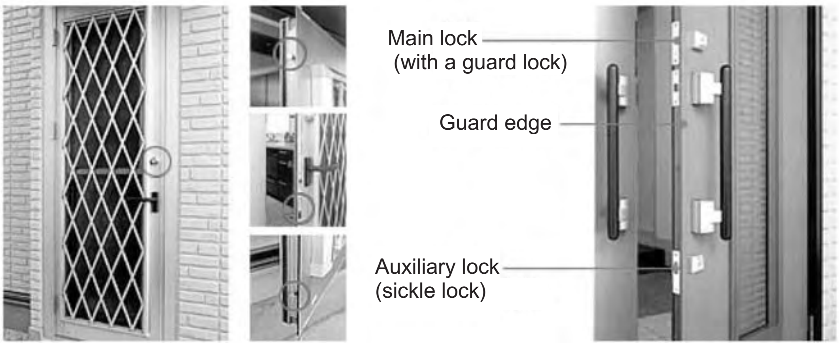
To prevent sick house syndrome, building materials of F☆☆☆☆ grade were used for both the interior finish and the inside of the ceiling.

A number of security measures were taken to ensure safety, including the installation of crime-prevention architectural components in all doors and windows on the first floor, and the window of the second floor balcony.



① Precision factory-manufactured moisture-proof film with a vapor-deposited aluminum coating acts as a barrier to moisture generated in rooms.
② The air layer discharges any moisture inside the walls to the outside, thus preventing the condensation of moisture in the walls that could corrode building materials and reduce their service life.

Cross section of the thermal insulation layer in the outer wall



Security measures incorporated in the front door

Q_H2: Ensuring Long Service Life

A highly durable and earthquake-resistant building frame improved the building's basic performance to ensure a long service life (Grade 4 assessment under the Deterioration Resistance Grades (Building Structure, etc.) and Grade 3 assessment under the Seismic Resistance Grades (Prevention of Collapse of Building Structures) of the Japan Housing Performance Indication Standards).

The facilities for inspecting and cleaning water supply and drainage equipment were improved (Grade 3 assessment under the Maintenance Grades (Dedicated Piping) of the Japan Housing Performance Indication Standards). Also, the use of a water supply/hot-water supply header and a drainage header will facilitate any future extension or replacement. A maintenance and inspection system that forms part of a long-term maintenance program, the provision of a manual to the occupants when they move into the house, and the issuance of certificates after regular inspections provide for the house's long-term maintenance.

Barrier-free design (flat floor surface)

In terms of functionality, the building was planned with a barrier-free design (Grade 3 assessment under the Elderly Friendliness Grades (Dedicated Spaces) of the Japan Housing Performance Indication Standards) and the appropriate space and floor plans were secured so that it could be used by the next generation.

Q_H3: Creating a Richer Townscape and Ecosystem

The planting of tall trees and shrubs for wild birds in the garden of about 50 m^2 (approximately 60% of the external area) creates a biological environment on the site.

Also, an open area planned for the side facing the road and along the boundaries with the adjacent land, together with the provision of evacuation routes and space for firefighting, contribute to the safety and security of the community.

LR_H1: Conserving Energy and Water

Energy conservation was the aim of the high-quality insulation in the building (Grade 4 assessment under the Energy-Saving Action Grades of the Japan Housing Performance Indication Standards). However, insufficient use of natural energy, such as solar radiation and natural wind, led to a low evaluation in "Energy Saving through Building Innovation."

Highly efficient water-heater and ventilation systems were installed. Further energy savings were realized by installing an insulated bathtub and a solar power generation system.

LR_H2: Using Resources Sparingly and Reducing Waste

Concern for resource conservation and waste reduction was shown by using cedar plywood that is recyclable for the roof sheathing material as well as the subfloor material on the first floor; cellulose fiber, which is a recycled material, to insulate the attic; and particleboard for the subfloor material on the second floor.

Furthermore, zero emissions were achieved in the relevant factories and on the construction site.

$LR_{H}3$: Consideration of the Global, Regional, and Surrounding Environment

Active greening of the site was performed to improve the thermal environment around the house.

One-third of the area of the visible facade of the house (up to 3 meters from the ground) is covered with green and shade. This offers not only the aesthetic benefit of exposing seasonal colors and flowers, but also the environmental benefits of shade and allowing breezes to enter the house, while giving privacy and assisting with security.

Outline of specifications:

Outline of structure	Foundation		Continuous footing: reinforced-concrete construction
	Building frames		Light-gauge steel construction
	Roof		Sloping roof 4.5/10
Insulation specifications	Attic space		Cellulose fiber (blown in)
	Exterior wall		Glass wool boards + glass wool
	First floor		Glass wool
Exterior finish	Roof	Roof	Colored slate
		Eave soffits	Decorated calcium silicate boards
	Exterior wall		Fibrous cement calcium silicate boards
Interior finish	Subfloor	First floor	Structural plywood
		Second floor	Particleboard
	Wall material		Plasterboard
	Ceiling sheathing		Plasterboard
	Floor finish		Wooden floor
	Lavatory		Laminated flooring
Facilities	Hot-water supply		Gas water heater (size: 20)
	Bathtub		Insulated bathtub
	Solar power generation system		3 kW

Case 8: Wooden house in a suburban area

Outline of building:

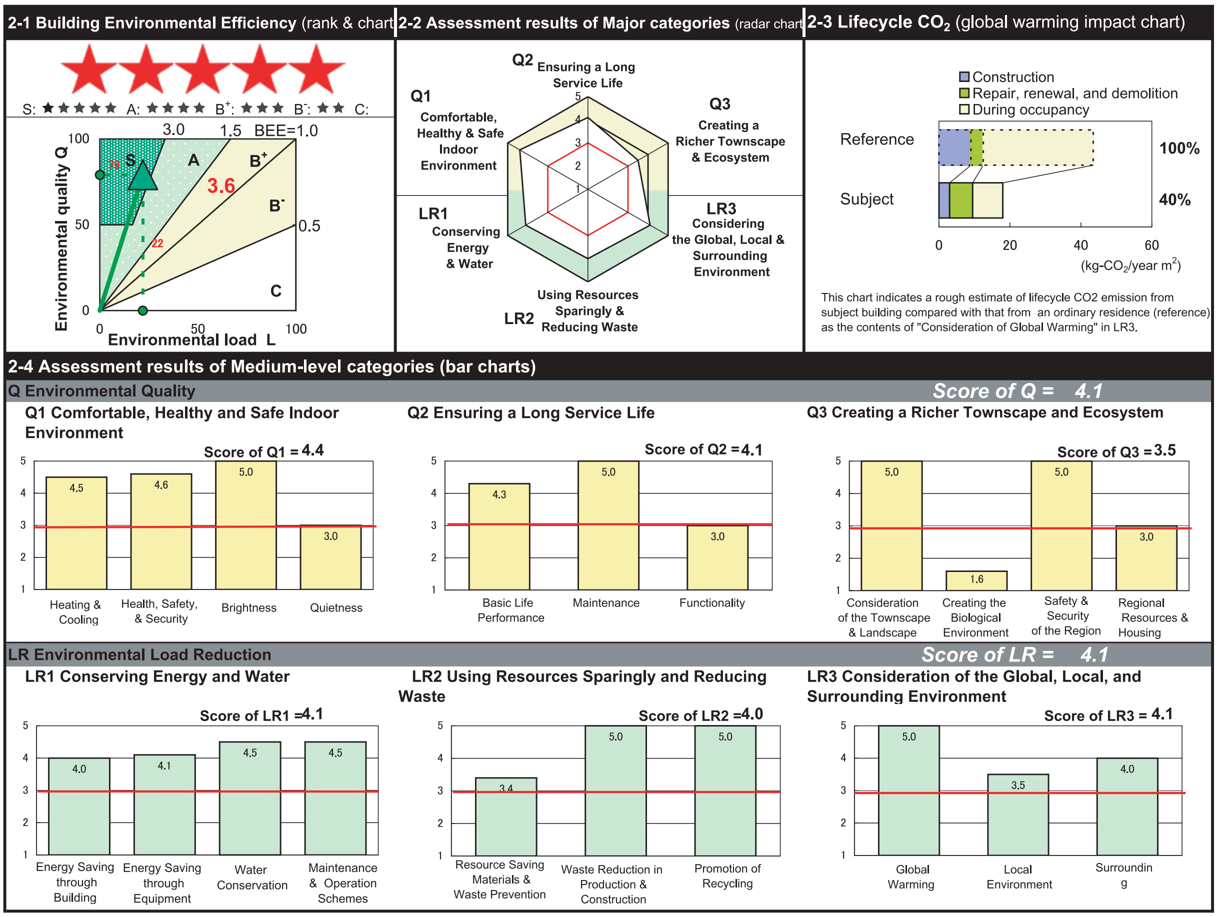
The house is located in the suburbs of a city in Ibaraki Prefecture and is adjacent to a large park on its western side. A large opening extending to the floor was placed in the western side of the living room from which 10-meter-high deciduous trees in the park can be seen, so that the occupants can appreciate the seasonal changes. The site extends from east to west, making it impossible to secure sufficient space in the south of the site to take advantage of the sun's rays during winter. Therefore, the performance of the building's insulation was planned so as to be equivalent to, or better than, the level defined in the next-generation energy-conservation standards. Because the northern side of the building is close to a neighboring building, consideration was given to the noise and exhaust of the water heater.

Outline of assessment:

Location	Ibaraki Prefecture
Energy-saving area classification	Zone IV
Passive area classification	D
Area/Zone	Category I residential zone
Year and month of completion	February 2007
Site area	141.9 m²
Building area	56.88 m²
Total floor area	109.84 m²
Number of stories	2 stories
Structure and construction	2 x 6 (unit) construction
No. of people in household	4

Implementation of assessment		Assessment date	August 20, 2007
		Stage when evaluated	Occupancy
	Conditions for assessment	Building specifications	Determined
		Site location	Determined
		Home electric appliances brought in	Determined
		Number of people	Determined
		Exterior	Determined

Assessment results:



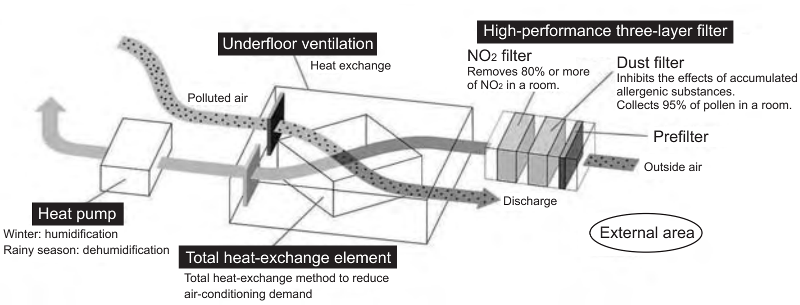
Considerations and attempts in design:

Q_H1: Making the Indoor Environment Comfortable, Healthy, and Safe

The narrow rectangular site running from east to west makes it impossible to secure enough space in the south of the block to take advantage of the sun's rays during winter. The house's design was therefore focused on the insulation/airtightness performance of the building to achieve both amenity (by exploiting interior horizontal and vertical temperature differences) and energy conservation (reducing the air-conditioning demand). Insulation materials made from fine-fiber glass wool (GW 13K/200 mm, GW 13K/140 mm, and GW 13K/140 mm) were respectively placed in the roof, walls, and floor. All window openings have sashes made from aluminum and resin and low-emissivity (low-e) glass to limit the heat loss as much as possible, giving the whole house a Q value of 1.6 W/m^2 K. This value is equivalent to, or greater than, the level defined in the next-generation energy-conservation standards (equivalent to the level of Zone I).

Large openings were placed in the southern side of the building (the opening ratio of the southern side is 49%) to allow sufficient entrance of daylight and direct solar radiation, while the main rooms-the living-dining-kitchen area and bedrooms-have openings in two directions to allow natural ventilation. In addition, an open room plan was used to allow natural ventilation, a barrier-free heat flow, and air conditioning of the entire building 24 hours a day (which has healthcare benefits such as prevention of heat shock). A class I heat-exchange ventilation system was employed to provide sufficient ventilation for each room and conserve energy. Shutters and screens in the first floor windows and laminated glass in the second floor windows were installed for security purposes.

Compound sash of aluminum and resin
(laminated glass specification)



Ventilation system

Q_H2: Ensuring Long Service Life

The exterior walls have an air layer to remove moisture that may penetrate the walls, in order to help maintain the building's durability (Grade 3 assessment under the Deterioration Resistance Grades (Building Structure, etc.) as specified in the Housing Quality Assurance Act). A soil survey indicated that the load-bearing capacity of the building's foundations was 3 tons. A mat foundation was used and its surface directly under the floor was covered with concrete. The walls of the house are of the high-load-bearing type and were erected in a balanced manner to ensure earthquake resistance (Grade 3 assessment under the Seismic Resistance Grades (Prevention of Collapse of Building Structures) as specified in the Housing Quality Assurance Act).

Mat foundation

Header piping was used for both water supply (hot-water supply) and drainage so that any future extension of water supply and drainage pipes can be easily managed (Grade 3 assessment under the Maintenance Grades (Dedicated Piping) as specified in the Housing Quality Assurance Act).

This is a rather small building for four occupants, with four rooms plus a living-dining-kitchen area in a total floor area of 109 m^2. Two children's rooms are connected via a study area placed in the second floor hall and can be used as a larger space by opening movable partitions. Thus, the house's design takes the interactions of the family members into consideration.

Water supply header

Drainage header

Q_H3: Creating a Richer Townscape and Ecosystem

The layout of the building was influenced by that of the surrounding buildings. Space was made for plants along the boundary with the road to meet the local building agreement that has a target area for vegetation of 21% of the site. An open space planned for the side facing the road and along the boundary with the adjoining land, together with the establishment of an evacuation route and area for firefighting, contribute to the safety and security of the community.

LR_H1: Conserving Energy and Water

Insulation performance equivalent to or exceeding the next-generation energy-conservation standards was targeted, so the latest air conditioner (annual performance factor [APF]: 5.7) was selected. The use of natural energy was evaluated as Level 1, because the location and shape of the site do not allow sufficient use of the winter sun.

The house has an electric heat-pump water heater (coefficient of performance [COP]: 4.9). Foam insulation covers the bathtub and insulation laid under the bathtub reduces heat loss.

Fluorescent lights were primarily used and an induction heater (IH) cooking stove was installed. However, the refrigerator and TV came from another house and their energy-saving standard achievement rates under the Act Concerning the Rational Use of Energy used for the scoring criteria in this assessment are unknown, resulting in a Level 1 rating. Solar power panels producing 3.97 kW of electricity were placed on the south-facing slope of the home's gable roof as high-efficiency energy equipment.

To save water, a thermostat type water faucet plus a water-saving shower head equipped with a hand-operated water-shutoff mechanism were installed in the bathroom, and a dishwasher and water-saving type toilet were also installed.

An energy simulation conducted during the design stage using heating and lighting costs in the owner's previous house showed the benefits of the energy-conservation equipment, and instruction manuals on how to use such equipment installed in this house were provided.

Solar power generation system

Energy consumption monitoring system

High-efficiency water heater

LR_H2: Using Resources Sparingly and Reducing Waste

The house frames consist of timber from FSC-certified forests. In addition, the materials used for some of the interior and exterior finish were selected with a view to resource conservation. For example, some of the waste material generated in the production process was reused for the exterior walls, and recycled materials such as recycled wooden boards or plasterboard were used as sheathing materials for the walls, roof, interior walls, and floor. However, the finish for the ceiling and interior walls is typical wallpaper due to cost and maintenance issues.

Furthermore, wastes generated in component factories and on the construction site were separated to improve the proportion of recycled materials, with the aim of achieving zero emissions.

LR_H3: Consideration of the Global, Regional, and Surrounding Environment

When the water heater was installed, consideration of exhaust and noise was necessary because the house is close to the adjoining land. With regard to the exhaust, the heater was located away from the windows and doors of the neighboring house and an attempt was made to attach additional directional louvers. To reduce noise, a relatively quiet unit (sound pressure level [SPL]: 40 dB) was selected. The outdoor unit of the air conditioner is somewhat noisy (47 dB for cooling and 49 dB for heating), so it was placed well away (at least 3 meters) from the adjacent land.

The establishment of vegetation is still at the design stage, but the planned green coverage was set at 29% in view of the surrounding thermal environment. However, the paved area takes up about 25% of the site because of the need for a two-car parking space, and an entranceway that joins the different road and site levels is needed.

A rainwater infiltration pit was installed to reduce the load on the local sewerage infrastructure.

Directional louvers for the water heater

Site of the air conditioner outdoor unit

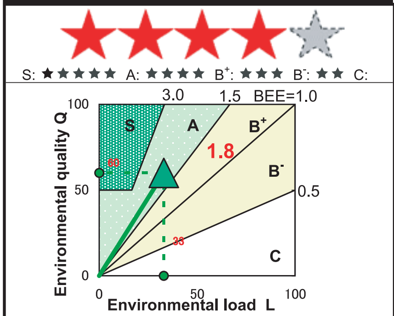
Outline of specifications:

Building frames	Structure		2 x 6 unit construction with ventilated-air layer inside exterior walls
	Insulation	Roof	Fine-fiber GW 13K/200 mm
		Walls	Fine-fiber GW 13K/140 mm
		Floor	Fine-fiber GW 13K/140 mm
		Windows	Compound sash of aluminum and resin + low-e glass
Interior finish	Subfloor	Particleboard 20 mm	
	Wall material	Plasterboard 12.5 mm	
	Ceiling sheathing	Plasterboard 12.5 mm	
	Floor finish	LDK, bedrooms	Wooden floor
		Western-style room, Japanese-style room	Wooden floor + tatami mats
		Washroom, lavatory	Soft floor
	Wall finish		Antibacterial vinyl wallpaper
	Ceiling finish		Antibacterial vinyl wallpaper
	Stairs		Plywood + decorative polyolefin sheet
Exterior finish	Exterior wall finish		Hardwood block cement plates + acrylic silicon coating
	Roof finish		Polymer reinforced fiber-based cement roof tiles + inorganic coating
Facilities	Hot-water supply		Electric heat-pump water heater
	Air-conditioning system		Air conditioner
	Solar power generation system		3.97 kW (single-crystal) system (with electric power monitor)

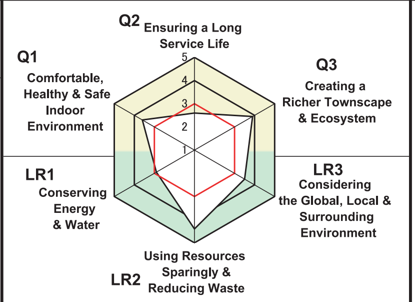
Case 9: Wooden house that makes effective use of local timber

Location: Kyoto City, Kyoto Prefecture
Land use zone: Category I exclusively low-story residential zone
Energy-saving area classification: Zone IV
Structure and construction: Conventional wooden construction
Number of stories: 2 stories above ground
Site area: 142 m²
Building area: 65 m²
Total floor area: 113 m²
No. of people in household: 7

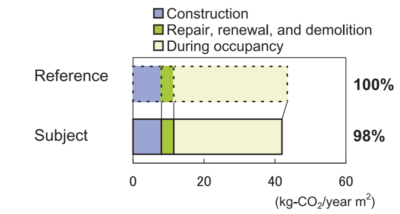
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)



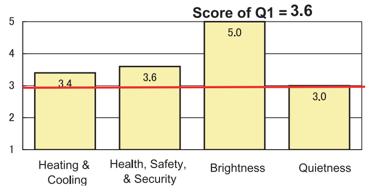
This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 3.4*

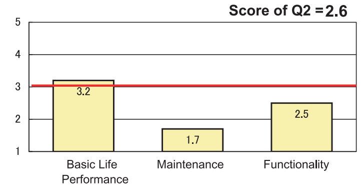
Q1 Comfortable, Healthy and Safe Indoor Environment

Score of Q1 = 3.6



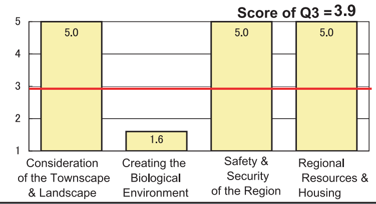
Q2 Ensuring a Long Service Life

Score of Q2 = 2.6



Q3 Creating a Richer Townscape and Ecosystem

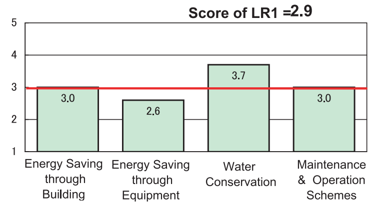
Score of Q3 = 3.9



LR Environmental Load Reduction — *Score of LR = 3.6*

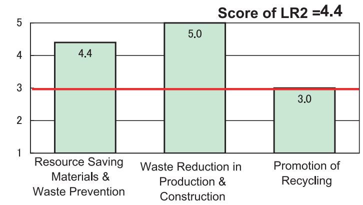
LR1 Conserving Energy and Water

Score of LR1 = 2.9



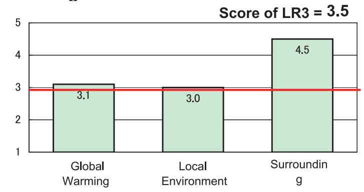
LR2 Using Resources Sparingly and Reducing Waste

Score of LR2 = 4.4



LR3 Consideration of the Global, Local, and Surrounding Environment

Score of LR3 = 3.5



3 Design Considerations

General

Local timber was used not only for the structural materials but also for the fittings and interior finish because the owner strongly wished to use local timber grown in the local climate. As a consequence of seeking to create a house that takes advantage of all the properties of wood, the minimum necessary equipment to allow daylight and natural airflow into the house was installed.

Others

One of the primary objectives was allowing the owner to easily understand how the house was built, such as by showing the workmanship of carpenters who process wood by hand. Consequently, when linked with the objective of using local timber, unprocessed timber was used instead of industrially processed wood to make the kitchen counter and shelves, and this required less energy than processed timber.

Q1 Comfortable, Healthy and Safe Indoor Environment

For the interior finish, local unprocessed timber was actively used to minimize the need for new construction materials. The materials are expected to adjust to variations in humidity, and consideration was given in the floor plan and when locating openings to ensure a natural airflow and the entry of daylight (e.g., effective use of skylights). Sheathing roof boards and insulation boards were used in the roof in order to reduce the noise of rain.

Q2 Ensuring a Long Service Life

Underfloor ventilation incorporated both foundation packing and regular ventilation openings. Because of the size of the lot, the area available for the house itself was small relative to the family size. Thus, the house was designed so that partitions could be used to modify space in accordance with the children's growth and a loft was also built.

Q3 Creating a Richer Townscape and Ecosystem

Because of design preferences and local building characteristics, the house was given a Japanese-style appearance, including a tiled roof with long eaves and lattice walls. With regard to planting, existing plants were preserved and a new planted area was created next to the parking lot, while the parking lot itself was covered with permeable material.

LR1 Conserving Energy and Water

Although the installation of a solar water heater was examined, it turned out to be too difficult to use in conjunction with an electric water heater. Consequently, equipment of general specifications was adopted. Consideration was given to the location of the air-conditioning system and its outdoor unit. In addition, rooms that would be used for long periods of time were equipped as much as possible with fluorescent lights and compact fluorescent lights.

LR2 Using Resources Sparingly and Reducing Waste

Local timber was used as efficiently as possible for structural and interior materials. Unprocessed timber was mainly used in conjunction with plastering, which helped to reduce construction waste.

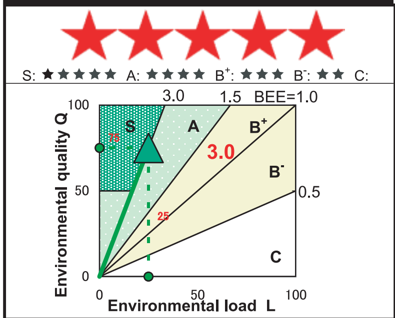
LR3 Consideration of the Global, Regional, and Surrounding Environment

The neighbors were taken into consideration when locating building openings and the outdoor units of the air conditioner. Plants were kept in their original positions as much as possible, since the house was rebuilt on the site of a former structure. The owner considered the installation of a rainwater supply system after the house was completed, and was advised on its installation and operation.

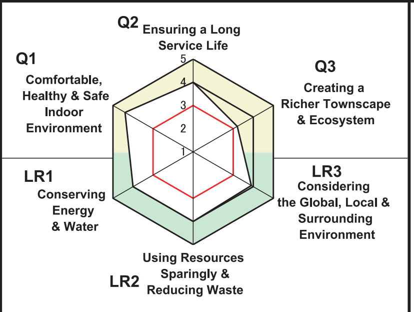
Case 10: Wooden house built with comprehensive environmental consideration

Location: Kyoto City, Kyoto Prefecture
Land use zone: Category I exclusively low-story residential zone
Energy-saving area classification: Zone IV
Structure and construction: Wooden structure, two-by-four construction
Number of stories: 2 stories above ground
Site area: 127 m²
Building area: 70 m²
Total floor area: 123 m²
No. of people in household: 4

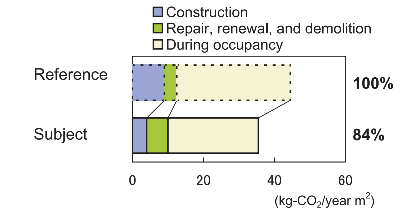
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

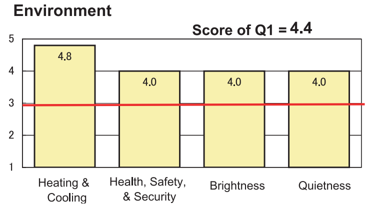


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

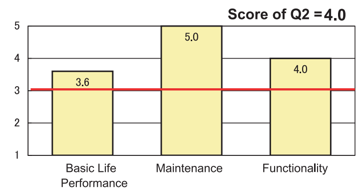
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — ***Score of Q = 4.0***

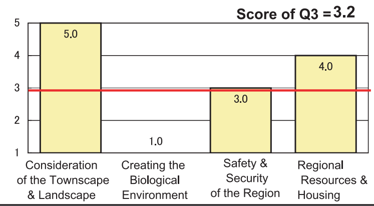
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

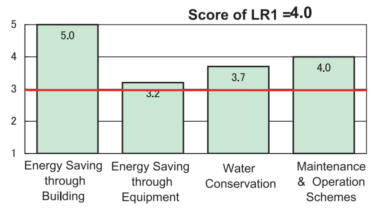


Q3 Creating a Richer Townscape and Ecosystem

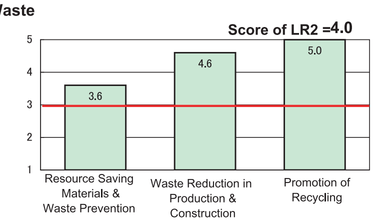


LR Environmental Load Reduction — ***Score of LR = 4.0***

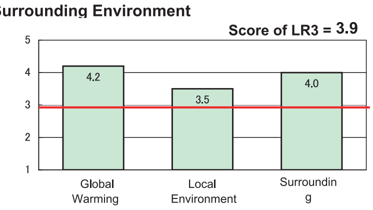
LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste



LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General

This building incorporates measures for safety, comfort, health, and economic efficiency as set forth in the housing charter of the World Health Organization (WHO)), as well as CO_2 emissions. It was designed to protect asset value while considering the global environment (zero energy consumption) and a long service life (100-year lifespan) by paying attention to the region and landscape and by achieving the thermal environment desired by the owner.

Others

Q1 Comfortable, Healthy and Safe Indoor Environment

The focus was placed on the thermal environment. Rigid polyurethane foam more than 100 mm thick was laid in the floors, walls, and ceilings. The airflow and insulation were controlled by the positions of the openings and the use of heat-reflecting glass. Heating and cooling is performed by a highly efficient air-conditioning system. The ventilation target was set at 0.5 or less in terms of airtightness measurement, with ventilation planned to be continuous for 24 hours per day. Insulated doors and sashes were installed.

Q2 Ensuring a Long Service Life

Prolongation of the life of the building's frame was promoted by the use of dried timber and the adoption of a construction method by which a ventilated-air layer is created inside the exterior walls. A seismic-resistant design, complete electrification, and a water-supply header system were adopted. Maintenance management was considered by providing maintenance manuals for the house and equipment as well as other basic information.

Q3 Creating a Richer Townscape and Ecosystem

The building was designed to harmonize with neighboring buildings.

LR1 Conserving Energy and Water

The water heater was installed inside the house, taking the utilization of its radiative heat into consideration. Water-saving toilets and a dishwasher were also installed. Instruction manuals for the building and its equipment were provided to give the occupants relevant information.

LR2 Using Resources Sparingly and Reducing Waste

Timber from sustainably managed forests was used in the building. The generation of byproducts at the building frame production and processing stages was limited, and the occupants were provided with related information.

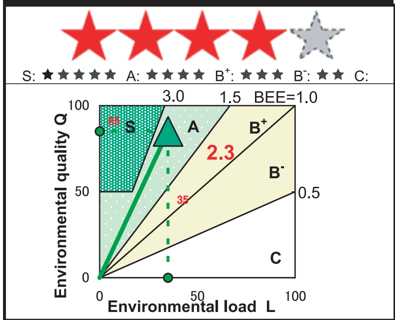
LR3 Consideration of the Global, Regional, and Surrounding Environment

Measures were taken against vibration, noise, exhaust gases, and waste heat in consideration of the neighbors.

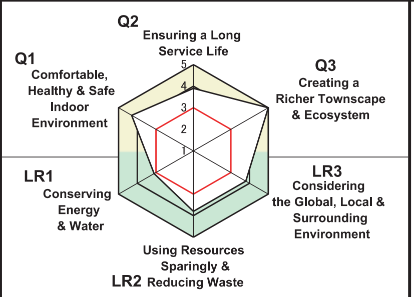
Case 11: Wooden passive type house constructed in a new town

Location: Ogoori City, Fukuoka Prefecture
Land use zone: Category I medium-high oriented residential zone
Energy-saving area classification: Zone IV
Structure and construction: Conventional wooden construction
Number of stories: 2 stories above ground
Site area: 265 m^2
Building area: 695 m^2
Total floor area: 111 m^2
No. of people in household: 4

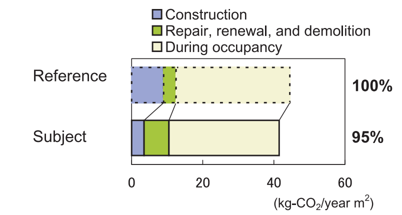
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

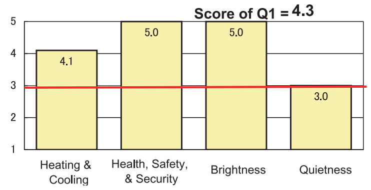


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

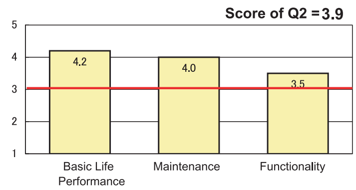
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 4.4*

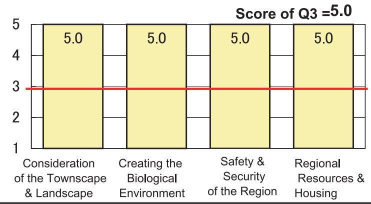
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

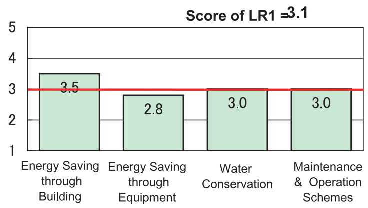


Q3 Creating a Richer Townscape and Ecosystem

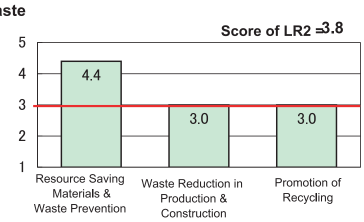


LR Environmental Load Reduction — *Score of LR = 3.5*

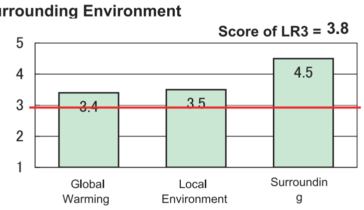
LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste



LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General

The first priority was making maximum use of available natural energy. The doors and windows can be opened completely during summer, and insulation and airtightness are good. Because the design aimed to produce clean air, the use of building materials that could emit total volatile organic compounds (TVOCs) was restricted. A skylight in the ceiling also allows the discharge of heat and stagnant air, resulting in a passive volumetric floor plan.

Others

Q1 Comfortable, Healthy and Safe Indoor Environment

The effective use of natural energy was prioritized in creating the thermal environment. The building was designed so that sunlight, heat, and wind can passively enter the rooms, and the equipment was located to support this strategy. This principle is reflected in the functional design of openings and eaves that take into account the angle of the sun.

Q2 Ensuring a Long Service Life

A framework that could be manipulated, including the use of wooden joints, was adopted to allow possible changes in the floor plan. The quality of the wooden joinery was guaranteed after selecting the most appropriate timber for each function. The piping of equipment whose life could affect the life of the house was placed aboveground for easy maintenance and prevention of deterioration. Measures to limit moisture around the house help to protect the strength of the foundations.

Q3 Creating a Richer Townscape and Ecosystem

The site is flat with an area of about 3,300 m^2, which was divided into 11 lots. It has no vegetation at all. Creating an ecological system and residential area from scratch is an important issue here. In the early stages of planning the town area, it was decided that a natural landscape would dominate as much as possible. For example, the designers aimed at converting the entire housing complex into a biotope by creating gardens with a variety of small trees.

LR1 Conserving Energy and Water

The design premise is a completely passive house, and the design attempts to realize this by the effective use of solar radiation during winter and by drawing in outdoor air through natural ventilation during summer. With the aim of reducing energy consumption by air conditioners, the openings were designed to ensure a comfortable temperature range in the house. In addition to the above measures, the establishment of vegetation outside the house allows rainwater to infiltrate the ground over the entire site.

LR2 Using Resources Sparingly and Reducing Waste

The use of timber from well-managed forests for all of the frames and associated wooden parts of the house was adopted as a standard specification. The choice of the most appropriate timber for each function was also a design requirement. To reduce the volume of wood waste, a house design utilizing measurements that improved the rate of timber yield was chosen. Secondary manufactured wooden products were not used. Complete use of timber components was promoted by a design based on modules using the Japanese measuring system.

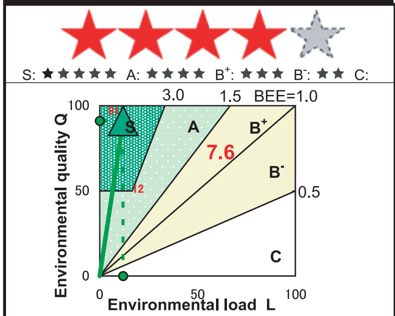
LR3 Consideration of the Global, Regional, and Surrounding Environment

The buildings and gardens are to be arranged so as to be a prototype of a new kind of housing area. Over the whole landscape, the green matrix is to be used in a natural way to link the existing adjoining blocks. As the building has no hidden sides due to its location, a design with distinct front and back sides was not possible. It was important to take the initiative in producing an ecological design that integrates the town and nature.

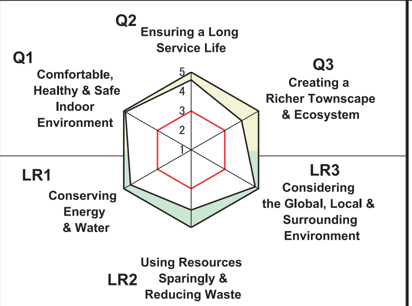
Case 12: Eco-friendly wooden house

Location: Shiraoka Town, Minami-Saitama, Saitama Prefecture
Land use zone: Category II medium-high oriented residential zone
Energy-saving area classification: Zone IV
Structure and construction: Conventional wooden construction
Number of stories: 2 stories above ground
Site area: 157 m²
Building area: 77 m²
Total floor area: 136 m²
No. of people in household: 4

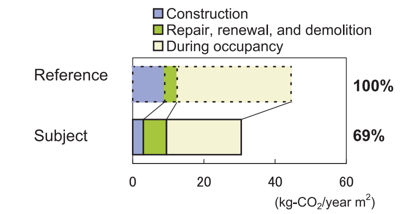
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

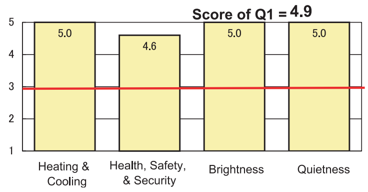


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

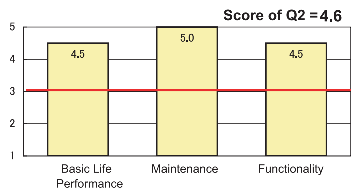
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — Score of Q = 4.6

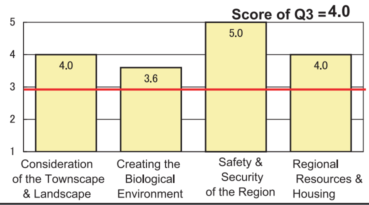
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

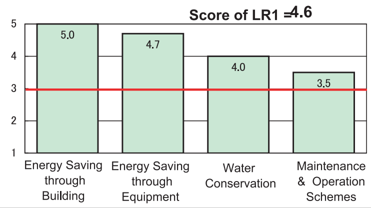


Q3 Creating a Richer Townscape and Ecosystem

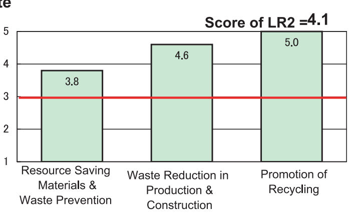


LR Environmental Load Reduction — Score of LR = 4.5

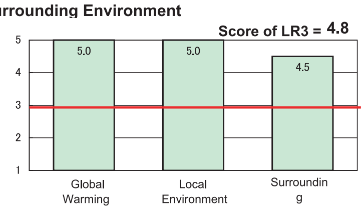
LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste



LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General

The design satisfied the ownerÅfs diverse requirements, such as energy conservation, use of natural materials, use of domestic and local timber, ease of living, high deterioration resistance, high seismic resistance, and integration into the neighborhood, while making use of conventional wooden construction methods.

Others

Q1 Comfortable, Healthy and Safe Indoor Environment

1. The house is well insulated and airtight, with ventilation controlled by the opening and closing of openings.
2. Consideration has been given to human health in the selection of materials, and the building is secure against crime and disasters.
3. The house meets the demands of modern living in terms of design, equipment, and the thermal environment; i.e., temperature and humidity, airflow, ventilation, the use of daylight, lighting, cooling and heating systems, etc.

Q2 Ensuring a Long Service Life

The policy is to use high-quality products that last for a long time.
1. Use of materials that degrade slowly and can be easily repaired.
2. Easy accessibility to the materials and structure in the future, due to the use of an open construction method.
3. Use of materials and details whose maintenance is easy.
4. Use of a construction method that allows easy extension and reconstruction.

Q3 Creating a Richer Townscape and Ecosystem

Consideration for the community is shown through the sharing of detailed information on local characteristics, the district plan, and the local ecosystem with the owner.

LR1 Conserving Energy and Water

1. An internally recycling residence was aimed for, so next-generation energy-conservation measures, natural energy, and the benefits of nature were harnessed. Highly efficient equipment that promotes energy saving and water conservation was installed.
2. In addition to hardware for energy saving, information on better styles of living and other useful information was provided.

LR2 Using Resources Sparingly and Reducing Waste

1. Significant amounts of recyclable materials were used, and recycled materials were used as much as possible.
2. Design and construction methods that do not generate waste were adopted, and the reuse of waste was promoted.

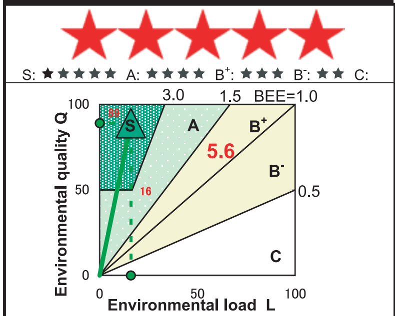
LR3 Consideration of the Global, Regional, and Surrounding Environment

1. The design and equipment were chosen in relation to the characteristics of the local neighborhood. 2. Rainwater was allowed to infiltrate into the site and its use was promoted. 3. Existing trees were protected and further greening of the site was conducted.

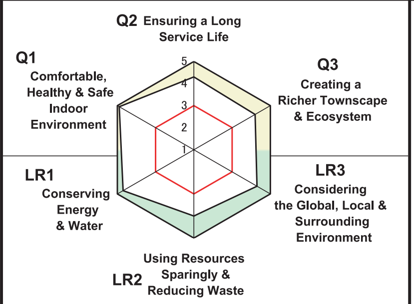
Case 13: Wooden house focusing on basic performance

Location: Hachioji City, Tokyo
Land use zone: Category I residential zone
Energy-saving area classification: Zone IV
Structure and construction: Conventional wooden construction
Number of stories: 2 stories above ground
Site area: 174 m²
Building area: 67 m²
Total floor area: 134 m²
No. of people in household: 1 or 2

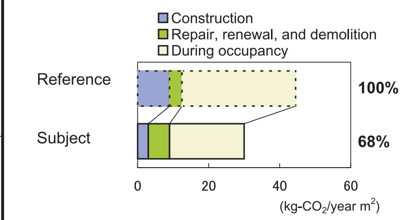
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

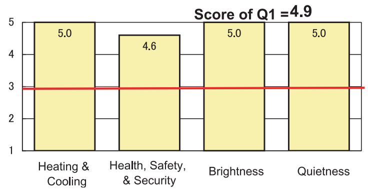


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

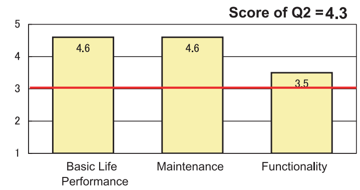
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 4.5*

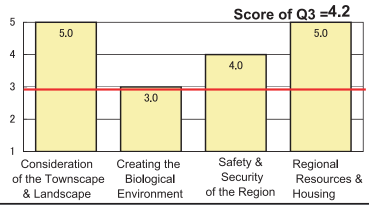
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

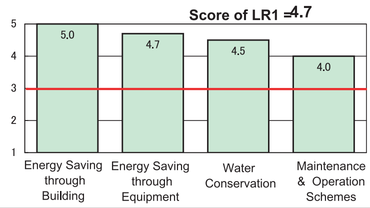


Q3 Creating a Richer Townscape and Ecosystem



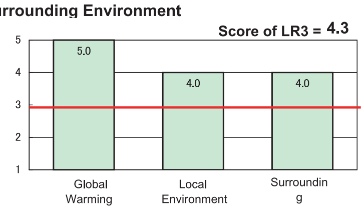
LR Environmental Load Reduction — *Score of LR = 4.3*

LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste

LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General

This environmental-control house is built on the western face of a cliff that has a high environmental potential. To avoid manufacturing processes determined by industrial capital, the use of natural materials, human labor, and the value of craftsmanship and skills were emphasized. This style of wooden house created by an "old but new" production approach was named "Mirai Wafuu" (Future Japanese Style). The house introduced here is the first in the "Mirai Wafuu" series.

Others

Emphasis was put on the skilled labor of craftsmen to move away from the current method of building houses, which depends on cutting and attaching industrial products. In other words, value is placed on the expression of manual dexterity. The building was designed as a whole to reduce the amount of maintenance work when completed. Self-cleaning windows and ventilation sashes were installed, and "Hydrotect" coating was applied. A heater system utilizing ground heat was adopted (operated during the spring, summer, and autumn seasons).

Q1 Comfortable, Healthy and Safe Indoor Environment

The house uses lime plaster and timber from trees felled just before a new moon and dried without removing their branches and leaves. Neither plywood nor gypsum board were used. Natural oil was applied instead of paint with volatile constituents. Industrial building materials were excluded and whole trees were used for building the house. The design makes full use of natural energy and enhances the performance of the building frames with vacuum insulation material and high-performance openings.

Q2 Ensuring a Long Service Life

Natural materials become more attractive as time passes and the owner becomes more attached to them. Skilled craftsmanship enhances their appearance, which becomes richer and more varied. The owner will be motivated to continue using the house because of its strong basic structure and the naturally changing appearance of the materials.

Q3 Creating a Richer Townscape and Ecosystem

The house built on the sloping face of a cliff has a unique basic shape that makes it appear to have been built not vertically but on a slant. This form of building was permitted for the first time under Article 6, Paragraph 1, Item 4 of the Building Standards Act.

LR1 Conserving Energy and Water

The house is all-electric. Energy efficiency was the first priority in selecting the hot-water supply system, home electric appliances, and lighting. All faucets have automatic sensors to prevent the wastage of water.

LR2 Using Resources Sparingly and Reducing Waste

Timber cut from Tenryuu cedar is used as the building material it is air-dried, which does not use fossil fuel. Details of the dried timber felled before a new moon have been kept for any future reuse of components. High-value-added timber sourced from entire trees was used, and even the sawdust was pressed into the walls. The insulation boards also created no waste wood by being shaped in the factory.

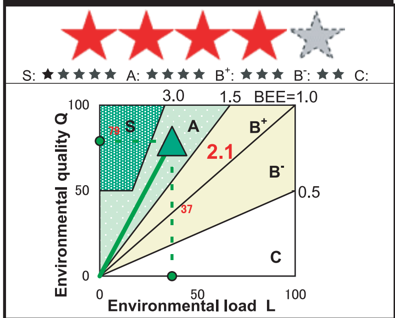
LR3 Consideration of the Global, Regional, and Surrounding Environment

A new method for slant-type development was adopted.

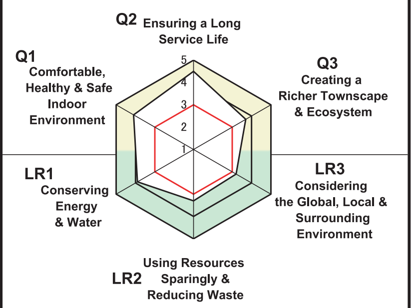
Case 14: Wooden house to be built in a suburban area (model assessment)

Location: Aichi Prefecture
Land use zone: Category I residential zone
Energy-saving area classification: Zone IV
Structure and construction: Conventional wooden construction
Number of stories: 2 stories above ground
Site area: -
Building area: 71 m²
Total floor area: 130 m²
No. of people in household: 4 (assumed number)

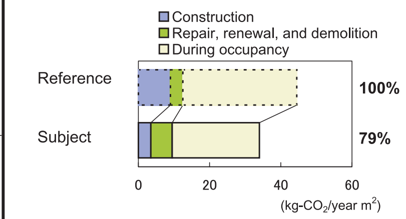
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

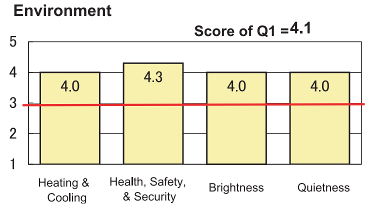


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

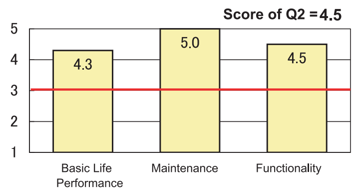
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 4.1*

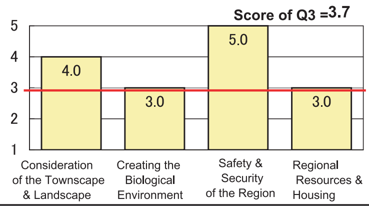
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

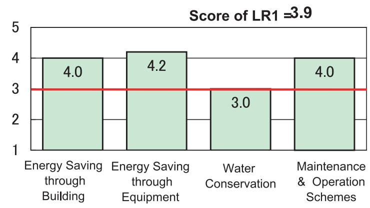


Q3 Creating a Richer Townscape and Ecosystem

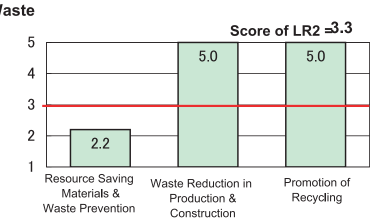


LR Environmental Load Reduction — *Score of LR = 3.5*

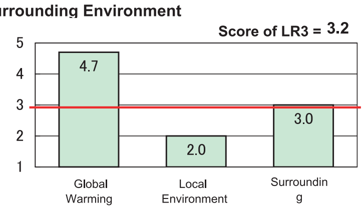
LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste



LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General

This is an airtight, well-insulated house to be built in a suburban area. The home electric appliances to be brought in are assumed to have high energy-saving standard achievement rates. The overall appearance, except for the car space, will harmonize with the surrounding buildings and greenery.

Others

The assessment was made at the design stage on the assumption that this model house would meet the next-generation energy-conservation standards.

Q1 Comfortable, Healthy and Safe Indoor Environment

It is an airtight, well-insulated house that meets the next-generation energy-conservation standards. An exhaust fan is located in the attic space to assist heat removal.

Q2 Ensuring a Long Service Life

The house is easy to maintain.

Q3 Creating a Richer Townscape and Ecosystem

The layout and appearance of the house have been planned so as to harmonize with the surrounding buildings and landscape.

LR1 Conserving Energy and Water

A small booklet on the appropriate way to live in the house will be given to the occupants when the house is handed over and guidance will be sent to them by mail twice a year.

LR2 Using Resources Sparingly and Reducing Waste

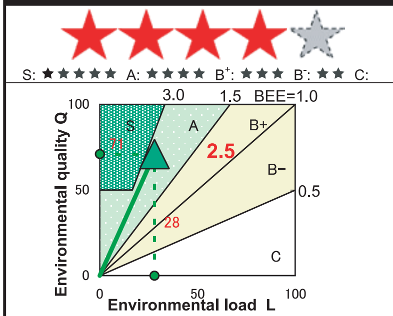
Byproducts will be reduced by the process control (PC) of structural components and thorough classification of byproducts at the construction site.

LR3 Consideration of the Global, Regional, and Surrounding Environment

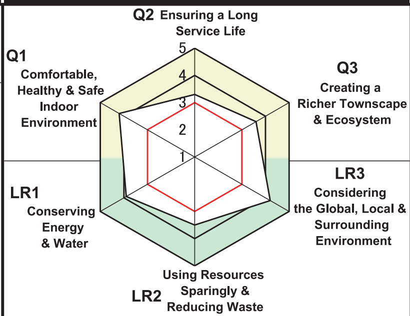
Case 15: Wooden house in an urban area equipped with the latest facilities

Location: Tokyo
Land use zone: Category I exclusively low-story residential zone
Energy-saving area classification: Zone IV
Structure and construction: Conventional wooden construction
Number of stories: 2 stories above ground
Site area: 101 m^2
Building area: 48 m^2
Total floor area: 80 m^2
No. of people in household: 3

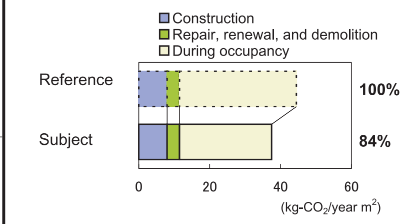
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

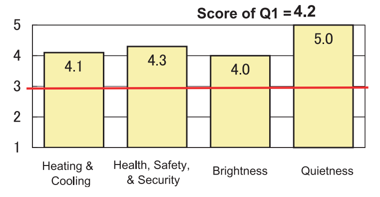


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

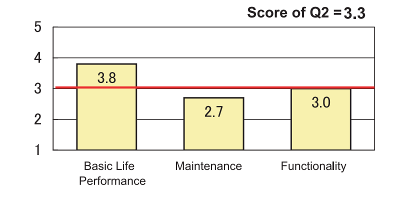
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 3.8*

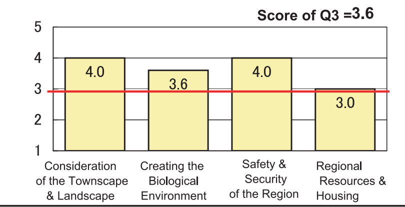
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

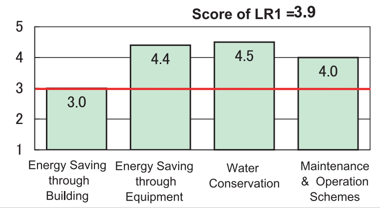


Q3 Creating a Richer Townscape and Ecosystem

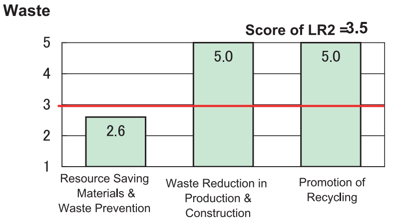


LR Environmental Load Reduction — *Score of LR = 3.8*

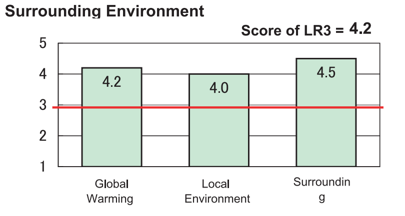
LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste



LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General

This is an all-electric house whose basic design concept is "to make a small house feel roomy, comfortable, and environmentally friendly." The second floor contains an integrated space without partitions that centers on a kitchen, and a living/dining room with a high ceiling is arranged across a loft above the kitchen. On the first floor, all partitions used for private rooms are movable to allow possible adjustments in the lifestyle of the owner's family. The design focuses on a good balance between "closed performance" and "open performance." In particular, insulation and airtightness are good because highly efficient equipment was installed, while due consideration was given in the plan for the entry of wind and daylight, as shown by the terraces installed in a diagonal line on the second floor and the insulated windows with wooden frames.

Others

Q1 Comfortable, Healthy and Safe Indoor Environment

Specifications for insulation and airtightness equivalent to the next-generation energy-conservation standards were adopted to reduce the heat load, and openings were located to ensure appropriate pathways for breezes and heat removal. Attention was also paid to air quality by various means such as measures against volatile organic compounds (VOCs) in building materials, an appropriate ventilation plan, and the use of natural materials for interior walls and ceilings (plastered walls) as well as humidity-controlling building materials.

Q2 Ensuring a Long Service Life

The house was designed so as to prevent damage to the building frames. For example, it satisfies the requirements of Seismic Resistance Grade 3 and Wind Resistance Grade 2 of the Housing Quality Assurance Act.

Q3 Creating a Richer Townscape and Ecosystem

As many plants as possible growing on the site were preserved and, as a result, 68% of the area outside the house was kept as green space. Visibility has been maintained by not building fences between the property and the road, while the house's position and exterior design conform with the district plan.

LR1 Conserving Energy and Water

A high-efficiency heat-pump cooling and heating system (with hot-water floor heating), high-efficiency floor-heating panels with a high heat-radiating capacity, and ceiling fans were installed. This choice of equipment saves energy and creates a comfortable atmosphere even in a large space. The house is all-electric, and is equipped with a highly efficient water heater ("Eco-cute") and an information technology (IT) type power distribution board (with peak cut function) that allows the control of home appliances from other locations; this helps to reduce fuel and lighting costs as well as energy consumption.

LR2 Using Resources Sparingly and Reducing Waste

Attention was paid to waste reduction at the construction stage by using precut timber.

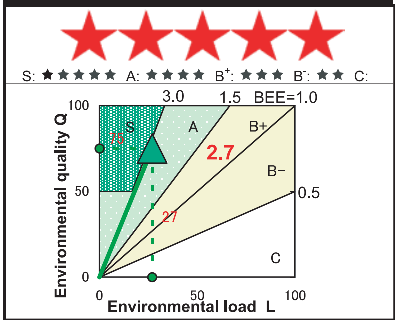
LR3 Consideration of the Global, Regional, and Surrounding Environment

Storage space for separated waste was provided under a terrace bench located on the second floor to reduce the waste disposal load. The plans aim at protection of the existing natural environment, and plants on the site will be kept intact as much as possible.

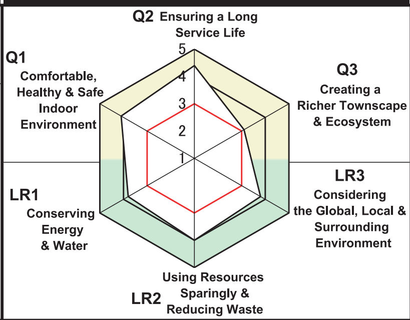
Case 16: Wooden house designed with consideration for energy conservation

Location: Nerima Ward, Tokyo
Land use zone: Category I residential zone
Energy-saving area classification: Zone IV
Structure and construction: Conventional wooden construction
Number of stories: 2 stories above ground
Site area: 117 m²
Building area: 68 m²
Total floor area: 116 m²
No. of people in household: 3

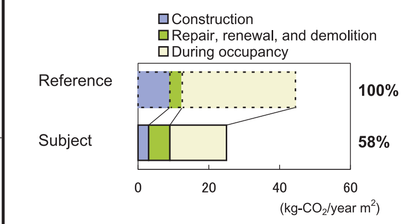
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

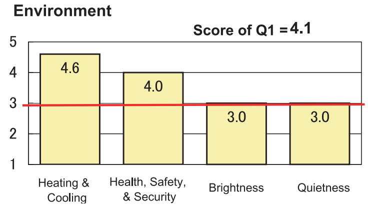


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

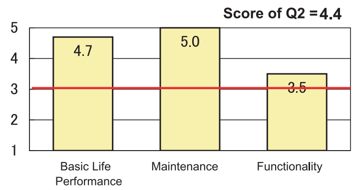
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — ***Score of Q = 3.9***

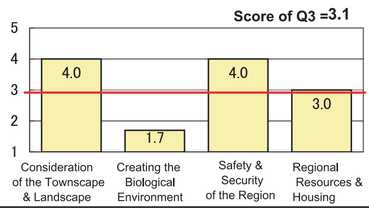
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

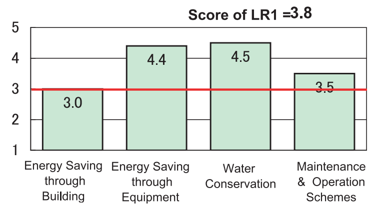


Q3 Creating a Richer Townscape and Ecosystem



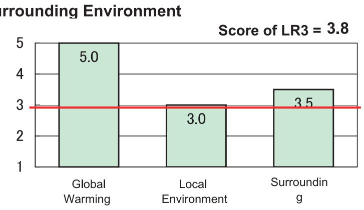
LR Environmental Load Reduction — ***Score of LR = 3.9***

LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste

LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General

The owner couple previously lived in an apartment with their five-year-old child, and built this house for themselves. The family will soon have a second child, and a large integrated space comprising a living room, dining room, and kitchen was planned so the family could get together, while ensuring that individual family members have their own room including future children's rooms. During planning, consideration was given to increasing energy conservation and security by improving both the building and its facilities so the family will be able to live safely in the house for a long time.

Others

The house is located in a quiet residential block with a long history; it is close to a suburban terminal station and many educational institutions. Although it was difficult to green the site because of its characteristics, the room plan effectively uses a large old tree growing in a neighbor's yard as "borrowed landscape."

Q1 Comfortable, Healthy and Safe Indoor Environment

The basic specifications of the house were set to meet Level 5 in both "Ensuring thermal insulation and airtightness performance" and "Countermeasures against chemical contaminants." In addition, the whole indoor environment has been enhanced by ensuring airflow through all rooms and an appropriate cooling and heating plan.

Q2 Ensuring a Long Service Life

Durable materials and a strong construction method were used for the building frames, exterior walls, and roof. Both "Resistance against natural disasters" and "Early detection of fire" have a Level 5 rating. These measures will allow the family to live safely in the house for a long time. Also, building maintenance was made easy by specifying appropriate equipment and establishing a management system.

Q3 Creating a Richer Townscape and Ecosystem

The house was given an earth color so it would be in harmony with the surrounding landscape. Trees providing food for birds were planted, although a large area of vegetation could not be established because of the site characteristics. An outdoor light with a sensor was installed for security and to provide visibility at night.

LR1 Conserving Energy and Water

A gas engine cogeneration system was used to supply hot water, heat, and part of the house's electricity needs. A solar power system was also installed, which helps to reduce primary energy demand. Other ideas that could contribute to the reduction of energy consumption throughout various living activities were also adopted, such as meters showing water and energy use.

LR2 Using Resources Sparingly and Reducing Waste

With regard to the exterior and interior finish materials, recycled materials were used for the sheathings. A reduction in the house's environmental load was realized by processing materials at a factory that has achieved zero emissions and by reducing wastage at the construction stage.

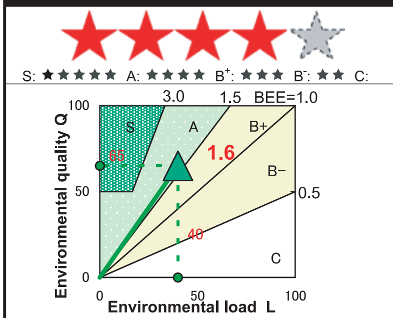
LR3 Consideration of the Global, Regional, and Surrounding Environment

Because the space between this house and neighboring houses is small, the location of equipment and the method of installation were chosen so as to not have an impact on neighbors. When planning the overall layout, some consideration was given such as the planting of local tree species. However, the contributions to "Improvement of the thermal environment of the surrounding area" and "Control of the burden on the local infrastructure" are low due to concrete finishing in more than half of the external area.

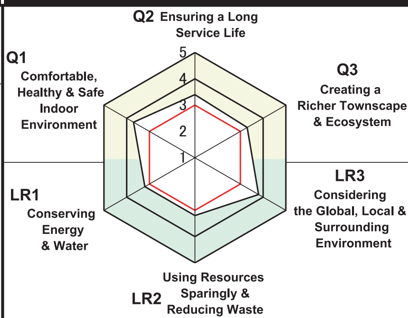
Case 17: Wooden house in an urban area equipped with the latest facilities

Location: Tokyo
Land use zone: Category I residential zone
Energy-saving area classification: Zone IV
Structure and construction: Conventional wooden construction
Number of stories: 2 stories above ground
Site area: 146 m²
Building area: 69 m²
Total floor area: 116 m²
No. of people in household: 3

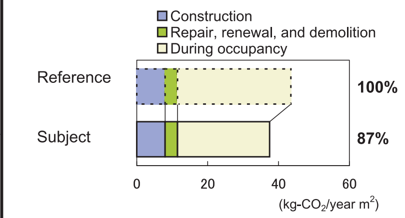
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

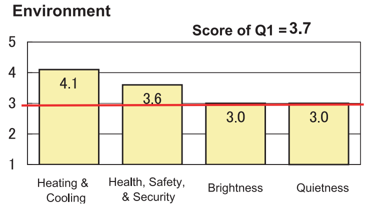


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

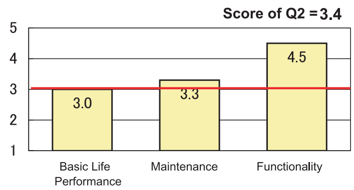
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 3.5*

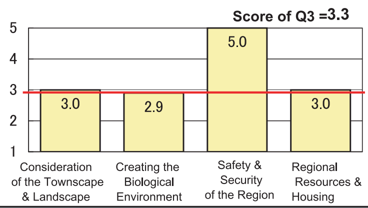
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

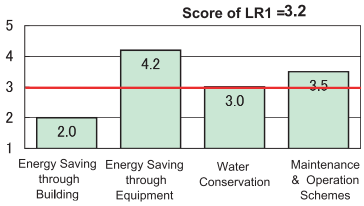


Q3 Creating a Richer Townscape and Ecosystem

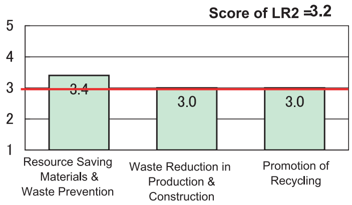


LR Environmental Load Reduction — *Score of LR = 3.4*

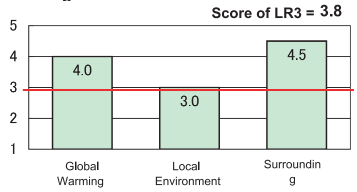
LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste



LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General

This is a conventional wooden house built by a leading housing company. Its basic performance achieves the next-generation energy-conservation standards. A home cogeneration system incorporating a fuel cell and a latent-heat-recovery type water heater supplies electricity and heat. This and the building's excellent insulation properties create an energy-efficient residence.

Others

Q1 Comfortable, Healthy and Safe Indoor Environment

The efficiency of the insulation meets the requirements of Grade 3 in the Energy-Saving Action Grades of the Japan Housing Performance Indication Standards. Airflow in two directions is possible in all rooms. A multipurpose room was designed to allow natural ventilation through its vaulted ceiling.

Q2 Ensuring a Long Service Life

The design makes the building highly durable and gives it a long life. A large space is created on the first floor by connecting the living/dining room with the multipurpose room that permits the occupants to use these rooms in various ways. The layout of the second floor provides flexibility, with partition walls that can be removed if necessary in the future.

Q3 Creating a Richer Townscape and Ecosystem

The plan for the external area took the surrounding landscape into consideration. For example, a green area faces the road, and flowerbeds and garden trees were arranged so as to be visible by pedestrians through a mesh fence.

LR1 Conserving Energy and Water

The latest home fuel-cell cogeneration system was installed to generate power on site, and waste heat recovered from this system is used efficiently.

LR2 Using Resources Sparingly and Reducing Waste

Waste was reduced by using precut materials and separate collection of waste at the construction site.

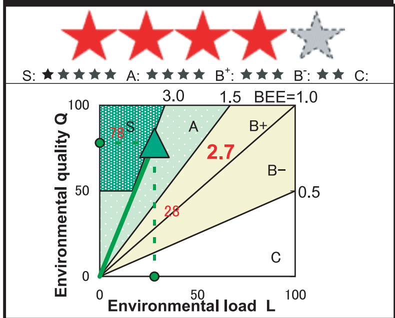
LR3 Consideration of the Global, Regional, and Surrounding Environment

Concrete surfaces were minimized on site, including the car parking space, which has a rainwater-permeable surface. Sustainably grown timber was used for the building frames.

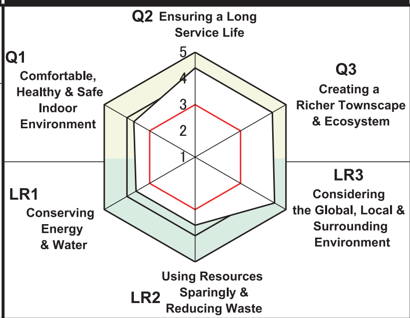
Case 18: Prefabricated steel-frame house built in an eco-friendly town

Location: Inagi City, Tokyo
Land use zone: Category I residential zone
Energy-saving area classification: Zone IV
Structure and construction: Steel framework construction
Number of stories: 2 stories above ground
Site area: -
Building area: 62 m²
Total floor area: 117 m²
No. of people in household: 3

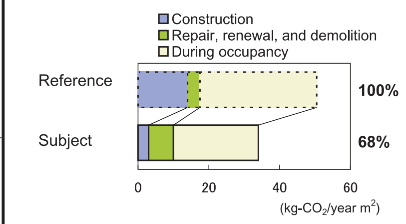
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)



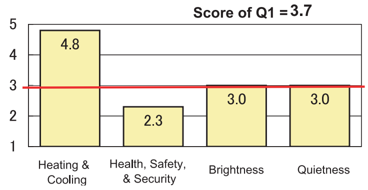
This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 4.1*

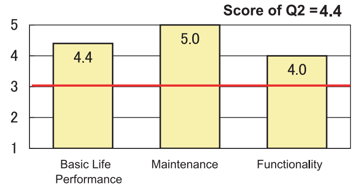
Q1 Comfortable, Healthy and Safe Indoor Environment

Score of Q1 =3.7



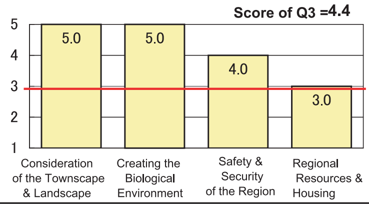
Q2 Ensuring a Long Service Life

Score of Q2 =4.4



Q3 Creating a Richer Townscape and Ecosystem

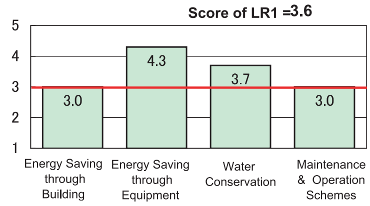
Score of Q3 =4.4



LR Environmental Load Reduction — *Score of LR = 3.8*

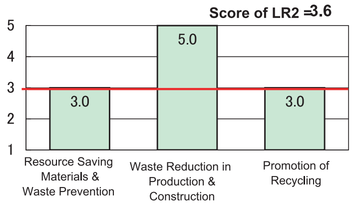
LR1 Conserving Energy and Water

Score of LR1 =3.6



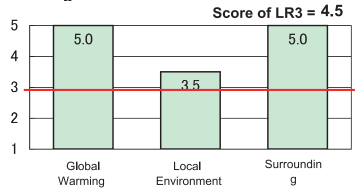
LR2 Using Resources Sparingly and Reducing Waste

Score of LR2 =3.6



LR3 Consideration of the Global, Local, and Surrounding Environment

Score of LR3 = 4.5



3 Design Considerations

General

This eco-friendly prefabricated steel-frame house built in a residential development takes the environment and townscape into consideration. The building achieved the highest levels for the performance of insulation, airtightness, and deterioration resistance, which are basic performance indicators. A variety of energy- and water-efficient equipment and home electric appliances were installed. In the garden, various types of trees, especially local species, were planted in addition to a lawn. Hedges were planted around the border of the site to ensure visibility. The environment of the townscape as well as that of the building and its external area were considered.

Others

Q1 Comfortable, Healthy and Safe Indoor Environment

The house has the highest possible ranking for thermal insulation and airtightness performance. Each room has openings in two directions to ensure airflow. A high-quality indoor environment was realized by using floor heating as the main heating method and a dedicated ventilation system that services the whole house. A mist sauna was installed in the bathroom and humidifiers were placed in each living room to provide for the health of the occupants.

Q2 Ensuring a Long Service Life

The house received the highest grade for deterioration resistance under the Housing Quality Assurance Act. Fire alarms are installed in the kitchen and living rooms for fire protection, while the maintenance and support system that contributes to the house's long-term use is well organized.

Q3 Creating a Richer Townscape and Ecosystem

The building lots for sale have been developed with due consideration given to the natural environment and townscape. Various types of trees, especially local species, were planted in the garden. Hedges of 1.2 meters in height were grown around the borders of the site and in the area facing the road to ensure visibility.

LR1 Conserving Energy and Water

The thermal load of the building itself was reduced by adopting next-generation specifications for the insulation. A latent-heat-recovery type heating/water-heater system was installed near the bathroom to reduce heat loss from the pipes, and is used as a heat source for the house and hot-water supply. Fluorescent lights are the main light source. In addition, energy- or water-saving facilities were installed, such as a high-efficiency cooking stove, high-efficiency toilet seat system, water-saving toilets, a dishwasher, and water-aeration type faucets.

LR2 Using Resources Sparingly and Reducing Waste

Large quantities of recycled resources were used in the building. In addition, waste generated during production and construction was recycled.

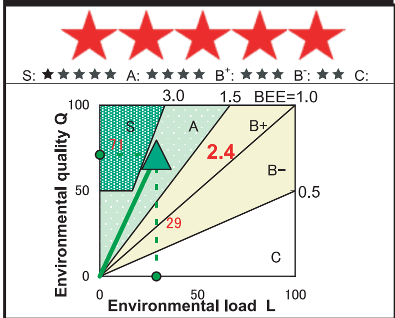
LR3 Consideration of the Global, Regional, and Surrounding Environment

Quiet equipment was installed in the large space between the house and neighboring dwellings. The majority of the external area was covered with vegetation and lawn, minimizing the paved area.

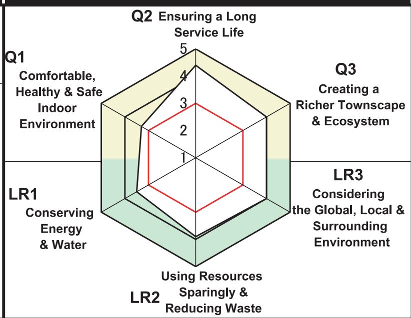
Case 19: Prefabricated steel-frame house built in a suburban area

Location: Kawasaki City, Kanagawa Prefecture
Land use zone: Category I residential zone
Energy-saving area classification: Zone IV
Structure and construction: Steel framework construction
Number of stories: 2 stories above ground
Site area: 180 m²
Building area: 69 m²
Total floor area: 128 m²
No. of people in household: 3

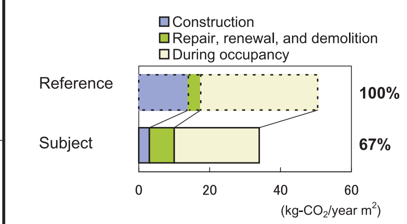
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



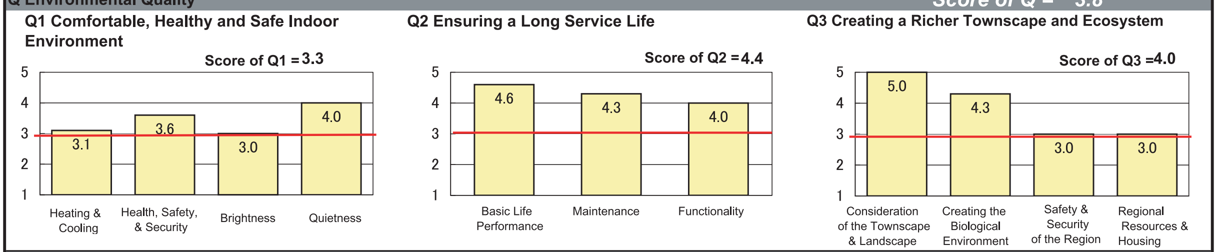
2-3 Lifecycle CO_2 (global warming impact chart)



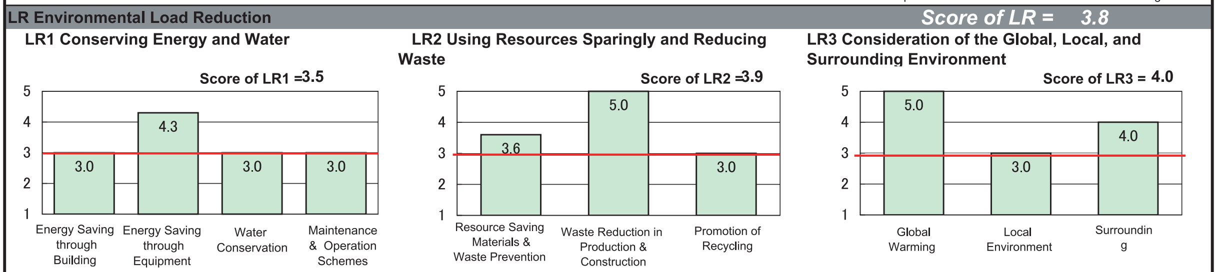
This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — ***Score of Q = 3.8***



LR Environmental Load Reduction — ***Score of LR = 3.8***



3 Design Considerations

General

This house is located on a suburban block. The exterior was planned to match the natural character of the adjoining forested hill. Consideration of environmental issues was very proactive, as shown in the choice of insulation that performs better than the next-generation energy-conservation standards and the use of various types of highly efficient equipment.

Others

Q1 Comfortable, Healthy and Safe Indoor Environment

The insulation and indoor air quality achieved the highest levels under the Housing Quality Assurance Act, ensuring a secure and comfortable life for the occupants.

Q2 Ensuring a Long Service Life

The building has the highest level of deterioration resistance as defined by the Housing Quality Assurance Act, and the support system for maintenance and refurbishment enables it to be occupied by future generations.

Q3 Creating a Richer Townscape and Ecosystem

The planting plan was organized so that many local plant species would be grown, providing new habitats for the area's birds and butterflies.

LR1 Conserving Energy and Water

A gas engine cogeneration system was adopted to suit the occupants' lifestyle.

LR2 Using Resources Sparingly and Reducing Waste

In addition to the active use of recycled materials, a zero-emission system for recycling waste generated during production and construction was established.

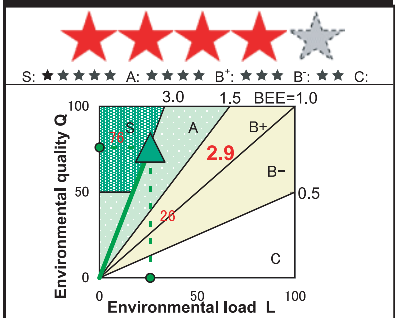
LR3 Consideration of the Global, Regional, and Surrounding Environment

The use of pavement was minimized around the house so as not to interrupt the natural circulation of water.

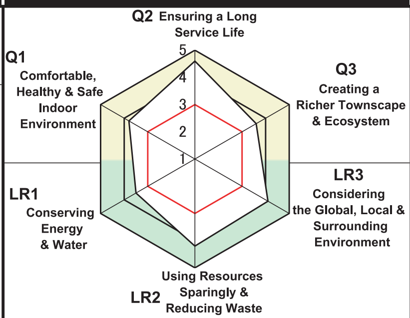
Case 20: Prefabricated wooden house to be built on an undetermined construction site (model assessment)

Location: -
Land use zone: Category I residential zone
Energy-saving area classification: Zone IV
Structure and construction: Prefabricated wooden construction
Number of stories: 2 stories above ground
Site area: Assumed site area
Building area: 66 m²
Total floor area: 131 m²
No. of people in household: 4

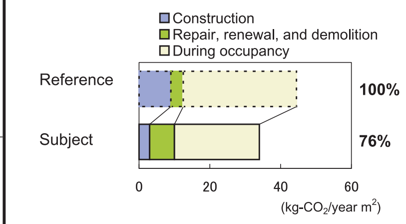
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

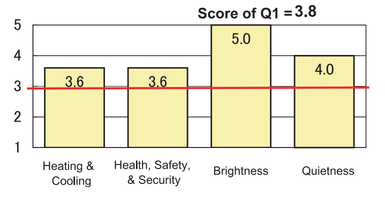


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

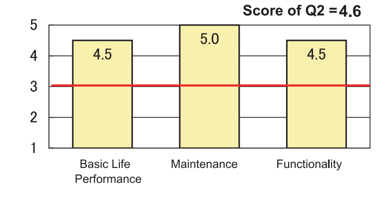
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 4.0*

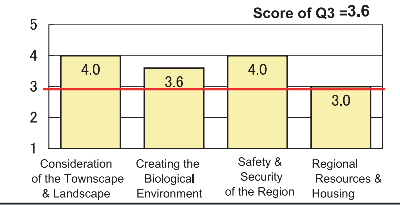
Q1 Comfortable, Healthy and Safe Indoor Environment — Score of Q1 = 3.8



Q2 Ensuring a Long Service Life — Score of Q2 = 4.6

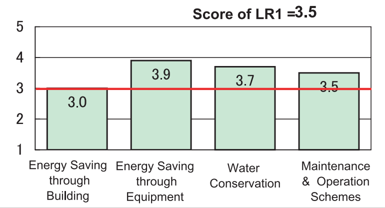


Q3 Creating a Richer Townscape and Ecosystem — Score of Q3 = 3.6

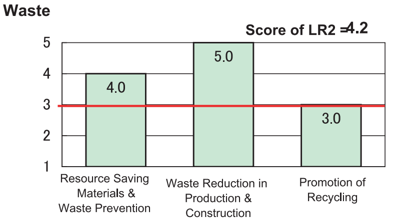


LR Environmental Load Reduction — *Score of LR = 3.9*

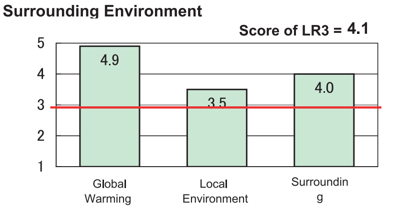
LR1 Conserving Energy and Water — Score of LR1 = 3.5



LR2 Using Resources Sparingly and Reducing Waste — Score of LR2 = 4.2



LR3 Consideration of the Global, Local, and Surrounding Environment — Score of LR3 = 4.1



3 Design Considerations

General

It is intended that this building's thermal loss coefficient Q, (a measure of the basic performance of a residence) will achieve the value for the next-generation energy-conservation standards because of good insulation and airtightness created by panel construction and the use of high-quality materials in the openings.

Others

Q1 Comfortable, Healthy and Safe Indoor Environment

A Class 1 heat-exchange type ventilation system (ventilation using fans for both air supply and exhaust) will be used to minimize temperature variations caused by continuous air circulation, thereby improving the internal thermal environment. This system will reduce the likelihood of the continuous ventilation being switched off to reduce discomfort, and will therefore maintain a good atmospheric environment.

Q2 Ensuring a Long Service Life

By preparing the proposed plan instead of a plan tailored to satisfy a specific family model, the functions of the house will be in place if any family moves in. Also, the routine inspection system is expected to detect and deal with any problems at an early stage.

Q3 Creating a Richer Townscape and Ecosystem

By considering the specifications of the exterior finish materials in relation to the image of the house to be created, the design will be able to blend in with the surrounding townscape.

LR1 Conserving Energy and Water

The heating and cooling load are reduced through insulation that satisfies the next-generation energy-conservation standards. In addition, a highly efficient gas water heater and gas kitchen equipment are used. Together, these measures serve to reduce the house's total energy consumption.

LR2 Using Resources Sparingly and Reducing Waste

The use of components produced in highly efficient factories will make economical resource use possible. Recycled materials will be used to a significant extent for both the exterior and interior finishes.

LR3 Consideration of the Global, Regional, and Surrounding Environment

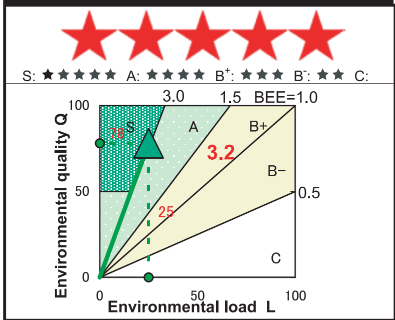
Afforestation is to be conducted on the sites from which this building's timber is taken, leading to the establishment of a system to preserve forests as resources.

3

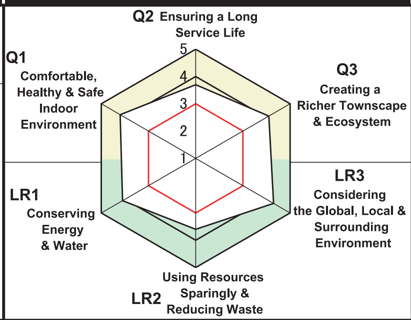
Case 21: Prefabricated steel-frame house built in a suburban area

Location: Ibaraki Prefecture
Land use zone: Category I residential zone
Energy-saving area classification: Zone IV
Structure and construction: Light-gauge steel unit construction
Number of stories: 2 stories above ground
Site area: 398 m²
Building area: 75 m²
Total floor area: 133 m²
No. of people in household: 2

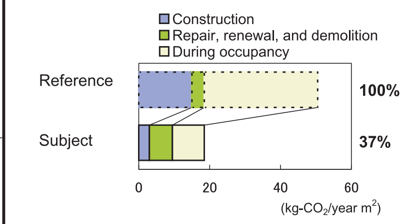
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

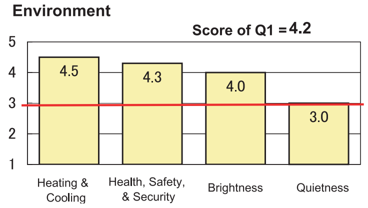


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

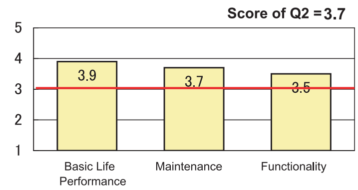
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 4.1*

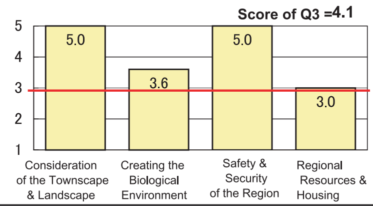
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

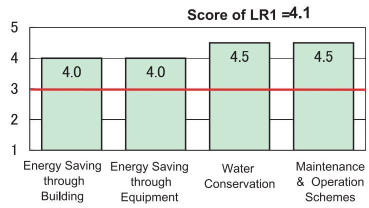


Q3 Creating a Richer Townscape and Ecosystem

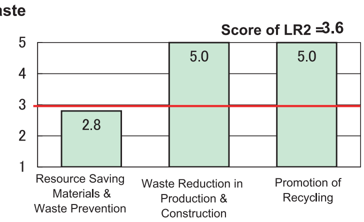


LR Environmental Load Reduction — *Score of LR = 4.0*

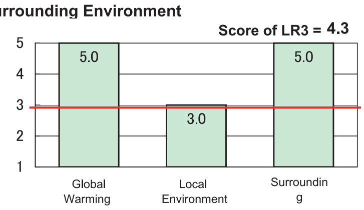
LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste



LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General	Others
This is a prefabricated light-gauge steel-frame house with a highly insulated building frame whose performance exceeds the next-generation energy-conservation standards. The insulation achieves both comfort (limited horizontal and vertical temperature variations) and energy conservation (reduced air-conditioning load).	

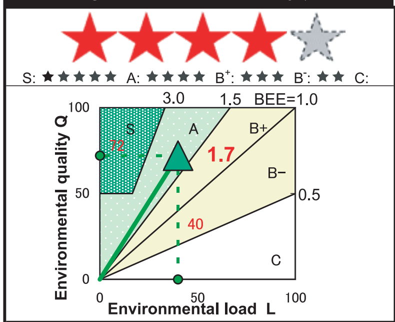
Q1 Comfortable, Healthy and Safe Indoor Environment	Q2 Ensuring a Long Service Life	Q3 Creating a Richer Townscape and Ecosystem
A 24-hour whole-building air-conditioning system (class 1 heat-exchange type ventilation system, ventilation using fans for both air supply and exhaust) was employed for health and safety reasons to prevent heat shock and ensure comfort when the windows are closed. An open floor plan and open ceiling were used as well as windows on two sides of the main living room. Insulating screens were installed in all openings to prevent heat loss from the windows.	Tiles were applied to the exterior walls to extend the life of the house.	About one-third of the site was covered with lawn.

LR1 Conserving Energy and Water	LR2 Using Resources Sparingly and Reducing Waste	LR3 Consideration of the Global, Regional, and Surrounding Environment
Air conditioning: A highly insulated building frame, whose performance exceeds the next-generation energy-conservation standards, reduces the air-conditioning load. Hot-water supply: Energy saving by the use of an electric heat-pump water heater. Solar power generation: Installation of a solar power generation system with a power output of 5.13 kW.	Zero emissions were achieved in the factories producing building components and on the construction site by reducing the amount of packaging around building components, standardizing the building components, and using precut timber.	

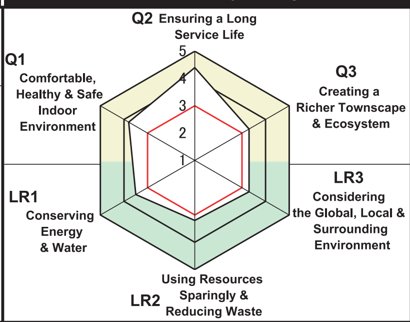
Case 22: Wooden house built on a site designated for symbiotic housing

Location: Kokubunji City, Tokyo
Land use zone: Category I residential zone
Energy-saving area classification: Zone IV
Structure and construction: Conventional wooden construction
Number of stories: 2 stories above ground
Site area: 115 m^2
Building area: 47 m^2
Total floor area: 90 m^2
No. of people in household: 4

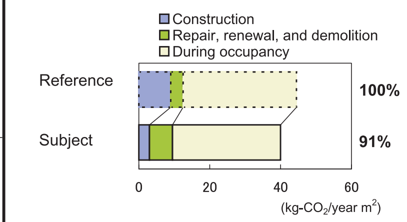
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

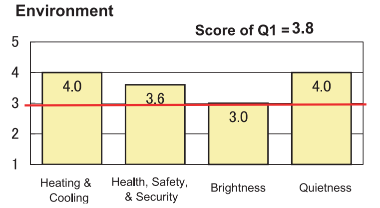


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

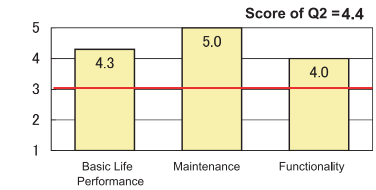
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 3.8*

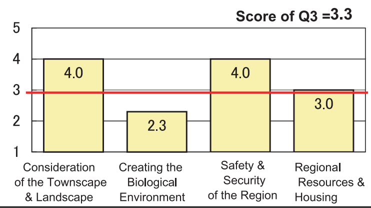
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

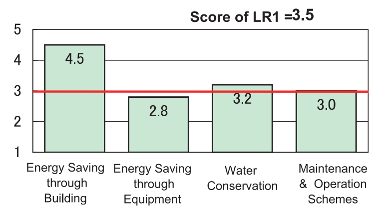


Q3 Creating a Richer Townscape and Ecosystem

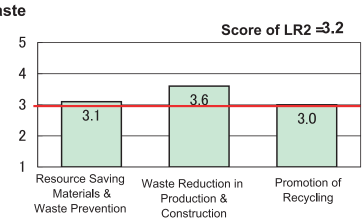


LR Environmental Load Reduction — *Score of LR = 3.3*

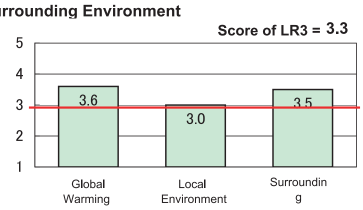
LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste



LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General

The house was built according to the specifications of the Environmentally Symbiotic Housing Certification system. It was built for sale in a suburban housing development with lots of about 116 m^2 in area. An open-style design was adopted for the entrance approach and parking space, while the exterior of each house was planned so as to harmonize with the surrounding townscape.

Others

Q1 Comfortable, Healthy and Safe Indoor Environment

Insulation with performance exceeding the next–generation energy-conservation standards is specified. Special attention was given to airflow, which was verified in advance by means of simulation. As an air-conditioning system is expected to be installed by the owner after purchase of the house, only outlets were installed.

Q2 Ensuring a Long Service Life

The preparation of a 60-year maintenance program will allow the occupants to live in the house for a long time. A header system is used for piping.

Q3 Creating a Richer Townscape and Ecosystem

Throughout the development, the exterior of each house was planned to blend in with the surrounding townscape. About 25% of each lot is covered by greenery.

LR1 Conserving Energy and Water

The insulation performance was specified to exceed the next-generation energy-conservation standards. Special attention was paid to airflow, and good airflow performance was ensured by advance simulation. It is expected that the owner will install an air-conditioning system after purchase of the house, so only outlets for the air conditioners were installed. The owner is also expected to install the lighting fixtures and home electric appliances after handover of the house, so the assessment was conducted only for the heated toilet seats. A rainwater tank was installed for rainwater use.

LR2 Using Resources Sparingly and Reducing Waste

Domestic timber accounts for 50% of all the timber used in the house. Precut building components were used, which reduced the amount of waste produced when processing the building frames and assisted recycling. All activities were conducted under the ISO 14000 environmental management system.

LR3 Consideration of the Global, Regional, and Surrounding Environment

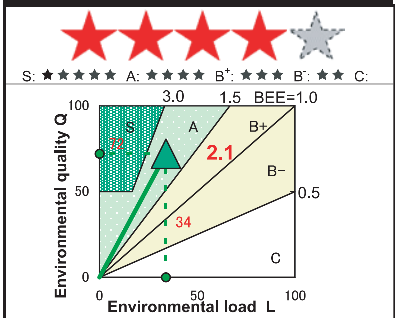
A rainwater tank was installed so rainwater can be used. The green coverage rate of the site is 15%, as a result of which the thermal impact on the surrounding area is limited.

3

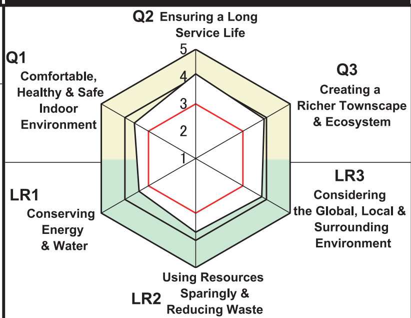
Case 23: Prefabricated steel-frame house to be built on an undetermined construction site (model assessment)

Location: Seto City, Aichi Prefecture
Land use zone: (not classified)
Energy-saving area classification: Zone IV
Structure and construction: Prefabricated light-gauge steel construction
Number of stories: 2 stories above ground
Site area: Assumed site
Building area: 75 m²
Total floor area: 150 m²
No. of people in household: 4 (assumption)

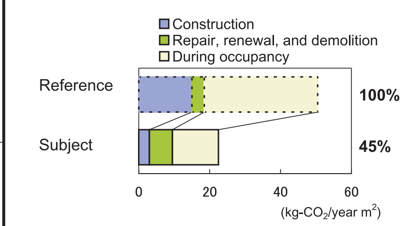
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

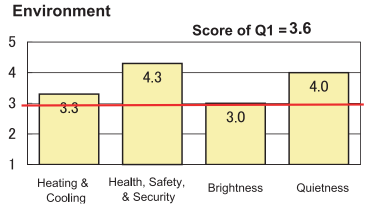


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

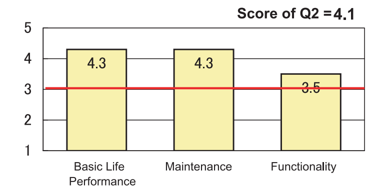
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 3.8*

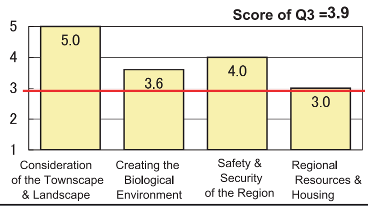
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

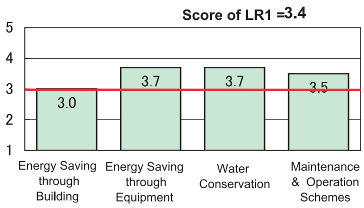


Q3 Creating a Richer Townscape and Ecosystem

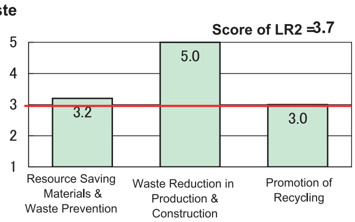


LR Environmental Load Reduction — *Score of LR = 3.6*

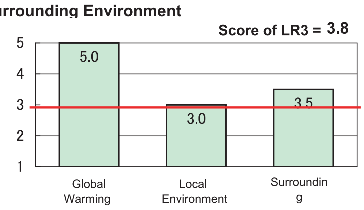
LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste



LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General

This is a house designed to be friendly to the global environment and people.
* Items of equipment such as air conditioners (part of QH1 and LRH1), which are expected to be chosen by the occupants, were assessed at the lowest levels because this was an assessment of a model plan. Also, items related to the site environment (QH3 and LRH3) represent the assessment of an assumed site.

Others

Q1 Comfortable, Healthy and Safe Indoor Environment

Consideration was given to insulation, solar radiation control, airflow, and heat removal to ensure a comfortable indoor environment. In addition, building materials and ventilation plans were also considered to guarantee the house's air quality. (* The air-conditioning system has not yet been specified.)

Q2 Ensuring a Long Service Life

Consideration was given to the impact of disasters, such as earthquakes and fires, as well as general deterioration, and consequently to maintenance of the house so that it can be used for a long time.

Q3 Creating a Richer Townscape and Ecosystem

Consideration was given to the local landscape and greening.

LR1 Conserving Energy and Water

Consideration was given to the conservation of energy and resources and the usage of natural energy. (* The air-conditioning system has not yet been specified.)

LR2 Using Resources Sparingly and Reducing Waste

Consideration was given to the use of recycled materials and zero emissions in the production and construction stages.

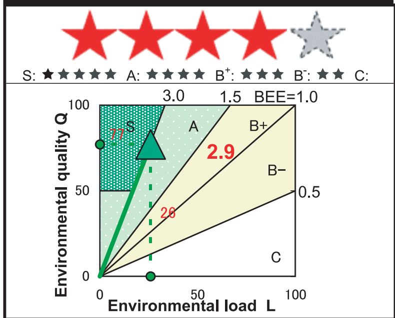
LR3 Consideration of the Global, Regional, and Surrounding Environment

Consideration was given to assisting the growth of vegetation by rainwater percolation and the planting of local tree species.

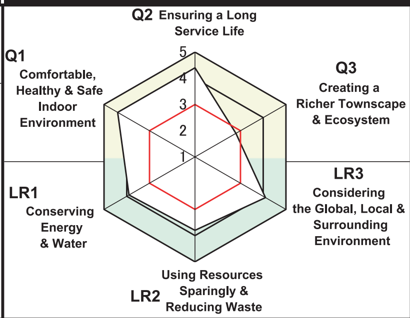
Case 24: Eco-friendly prefabricated wooden house to be built in the Tokyo metropolitan area
(model assessment)

Location: Assumed site (Tokyo metropolitan area, quasi-fire-prevention district)
Land use zone: Category I residential zone (assumption)
Energy-saving area classification: Zone IV
Structure and construction: Prefabricated wooden construction
Number of stories: 2 stories above ground
Site area: Assumed site
Building area: 106 m²
Total floor area: 207 m²
No. of people in household: 5 (assumption)

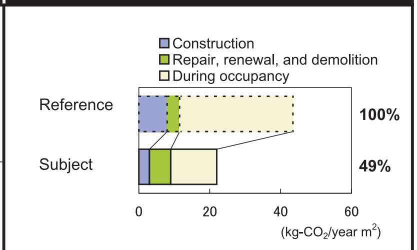
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

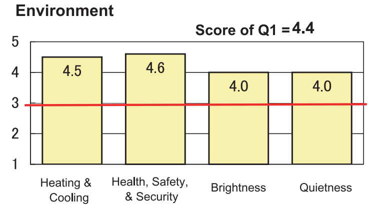


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

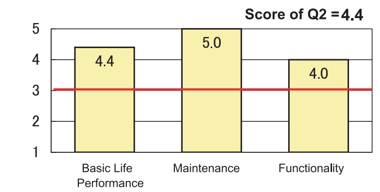
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 4.0*

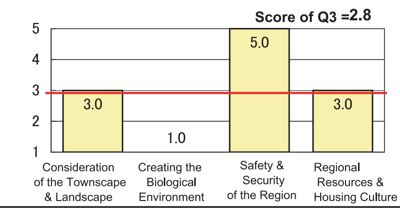
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

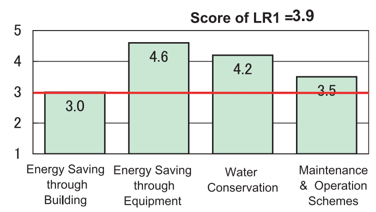


Q3 Creating a Richer Townscape and Ecosystem

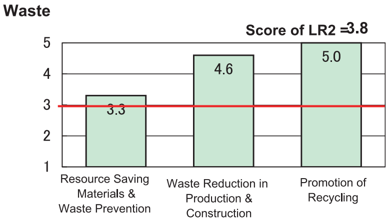


LR Environmental Load Reduction — *Score of LR = 3.9*

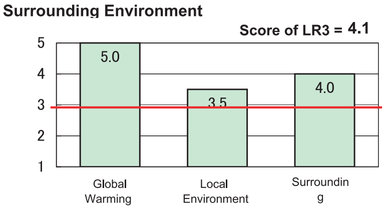
LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste



LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General

This is an environmentally symbiotic housing model with almost full environmentally symbiotic specifications.

Others

It is assumed that the house will be built on a specific site (a Category I residential zone in the Tokyo metropolitan area). However, it has been planned so as to satisfy the requirements for environmentally symbiotic housing.

Q1 Comfortable, Healthy and Safe Indoor Environment

1. The house has a Grade 4 assessment under the Energy-Saving Action Grades.
2. The main living room has openings in two directions.
3. The house has a Grade 3 assessment under Countermeasures against Formaldehyde.
4. The opening-to-floor ratio in the living room and main bedroom exceeds 20%. An effective daylight area is secured in the southern face of the house.

Q2 Ensuring a Long Service Life

1. The house has a Grade 3 assessment under the Deterioration Resistance Grades and a Grade 3 assessment under the Maintenance Grades.
2. Parts with a service life of 25 to 50 years are used for the exterior walls and roof, employing a construction method with a renewability rating of "a."
3. Structural resistance is secured by a combination of structural materials of the highest grades.
4. A sensor/alarm system is installed in the kitchen and bedrooms.

Q3 Creating a Richer Townscape and Ecosystem

1. The securing of an evacuation route and space for firefighting is planned.
2. The securing of visibility is planned.

LR1 Conserving Energy and Water

1. High-efficiency air-conditioning equipment.
2. An electric heat-pump water heater ("Eco-cute") is adopted.
3. Solar power generation system (3.12 kW).
4. Rainwater is used for toilet flushing.

LR2 Using Resources Sparingly and Reducing Waste

1. More than half of the structural frame members consist of timber from sustainably managed forests.

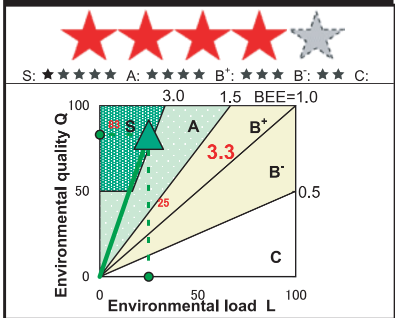
LR3 Consideration of the Global, Regional, and Surrounding Environment

1. The greenery coverage is planned to be 15% or more.
2. Rainwater percolation and rainwater use are adopted.
3. The planting of local species, which is an essential requirement for environmentally symbiotic housing, is planned.

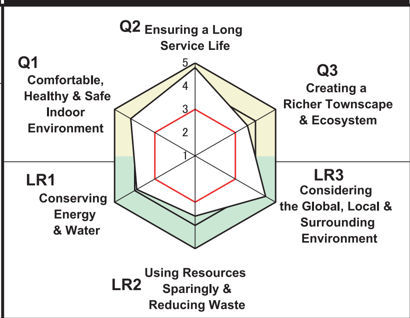
Case 25: Prefabricated steel-frame house built in a suburban area

Location: Tokyo
Land use zone: Category I residential zone, not designated as a fire-prevention district
Energy-saving area classification: Zone IV
Structure and construction: Prefabricated steel-frame construction
Number of stories: 2 stories above ground
Site area: 316 m²
Building area: 89 m²
Total floor area: 158 m²
No. of people in household: 4

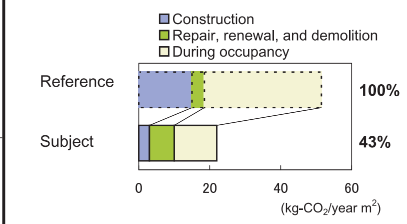
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

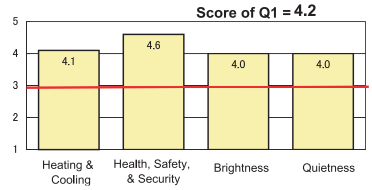


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

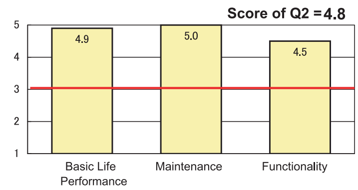
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — ***Score of Q = 4.3***

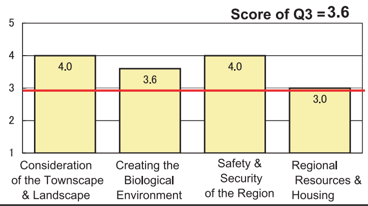
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

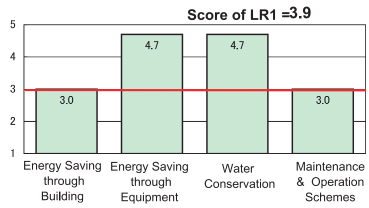


Q3 Creating a Richer Townscape and Ecosystem

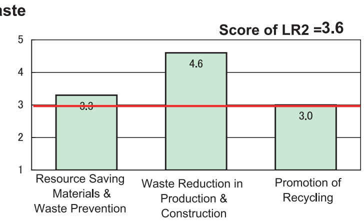


LR Environmental Load Reduction — ***Score of LR = 4.0***

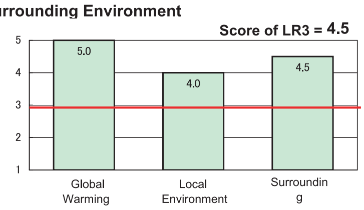
LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste



LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General	Others
This house has been built in Tokyo. In particular, the basic design incorporates high deterioration resistance and disaster-prevention measures to allow long-term use of the house. Energy-saving equipment, including a solar power generation system, was installed.	

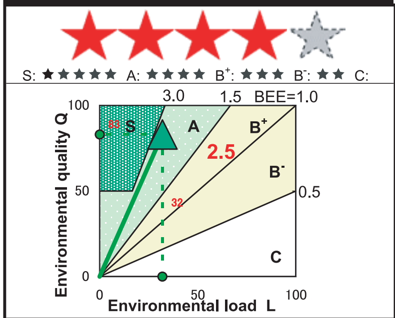
Q1 Comfortable, Healthy and Safe Indoor Environment	Q2 Ensuring a Long Service Life	Q3 Creating a Richer Townscape and Ecosystem
Openings were placed on two sides of each living room to allow air to flow through. A simulation was performed that verified the effectiveness of these openings. Also, an appropriate air-conditioning plan was implemented for the main living room. Among the anticrime measures, the openings on the first floor use fittings that meet crime prevention (CP) standards.	The building frame members have the highest grade of deterioration resistance. Other parts of the house are also expected to have a long life because the maintenance program relies on readily replaceable components. The maintenance support system is well organized. Also, the building received the highest ranking for seismic resistance and the exterior walls received the highest ranking for fire resistance.	As large an area as possible was set aside for vegetation in the planning stage. Sufficient space was secured around the building to enhance disaster prevention.

LR1 Conserving Energy and Water	LR2 Using Resources Sparingly and Reducing Waste	LR3 Consideration of the Global, Regional, and Surrounding Environment
To conserve energy, electric heat-pump floor heating, an electric heat-pump water heater, and a solar power generation system were installed.	The factory producing members for the building frames has ISO 14000 certification. Some of the other components used in the house are also from factories that have obtained ISO 14000 certification.	Most of the site's external area was finished so as to secure permeability and percolation pits were installed for rainwater drainage to reduce the rainwater drainage load.

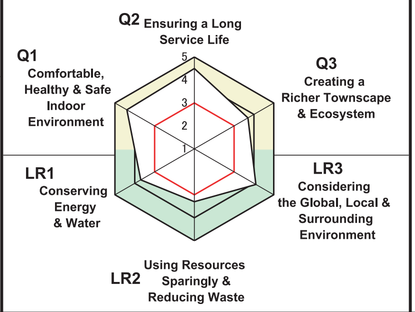
Case 26: Wooden house and lot offered for sale, which are at the planning stage

Location: Kanagawa Prefecture
Land use zone: Category I residential zone
Energy-saving area classification: Zone IV
Structure and construction: Conventional wooden construction
Number of stories: 2 stories above ground
Site area: 165 m²
Building area: 81 m²
Total floor area: 139 m²
No. of people in household: 4 (assumption)

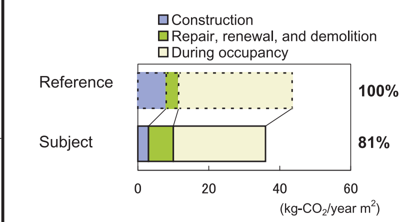
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

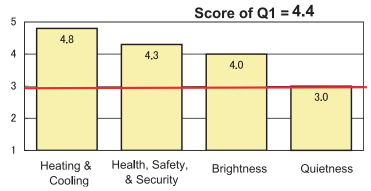


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

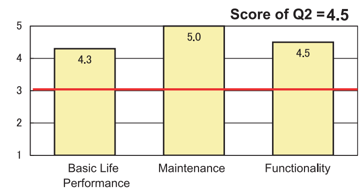
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 4.3*

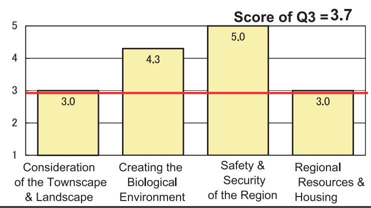
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

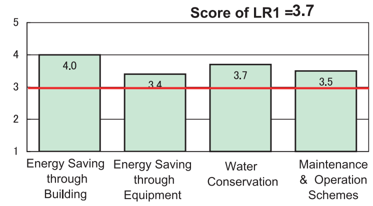


Q3 Creating a Richer Townscape and Ecosystem

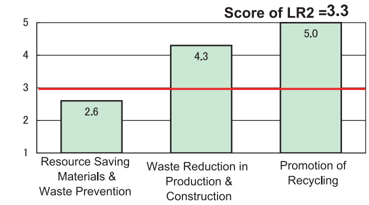


LR Environmental Load Reduction — *Score of LR = 3.7*

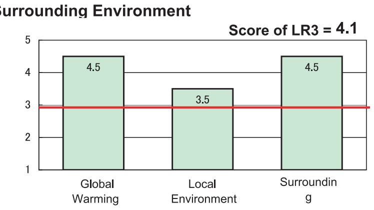
LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste



LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General

This case features a house and lot on highly vegetated developed land.
Regarding the Japan Housing Performance Indication System in this assessment case, the current next–generation energy-conservation standards were chosen instead of the New Energy Saving Code, and consequently rather higher evaluation grades were obtained. The other items to be evaluated mostly obtained grades corresponding to the standard specifications.

Others

Although the subject of the evaluation is an actual building, it was evaluated before construction.

Q1 Comfortable, Healthy and Safe Indoor Environment

Appropriate measures were taken in relation to energy saving, ventilation, airflow, heating, and cooling.
A home security system was installed, although anticrime measures were not evaluated highly.
The lighting design has not yet been decided.

Q2 Ensuring a Long Service Life

The highest rankings were obtained for deterioration resistance, seismic resistance (prevention of collapse), maintenance, and functionality of the building frames.
The deterioration resistance and fire resistance of parts other than the frames generally correspond to the standard levels for wooden houses.

Q3 Creating a Richer Townscape and Ecosystem

Standard measures were taken to address this topic.

LR1 Conserving Energy and Water

Some efforts were made that meet the requirements of Grade 4 of the Energy-Saving Grades.
No special efforts were made to use natural energy.
The lighting design has not yet been decided.

LR2 Using Resources Sparingly and Reducing Waste

No deliberate efforts were made to conserve resources, and this remains an issue to be addressed.
Some effort was made to reduce the generation of waste.

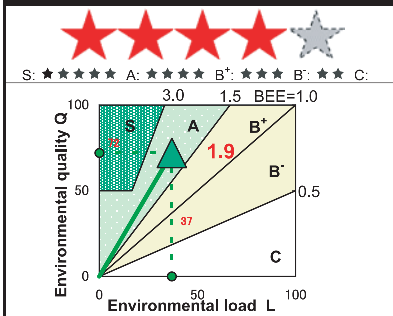
LR3 Consideration of the Global, Regional, and Surrounding Environment

Standard efforts were made for a house and lot offered for sale in a developed residential area.

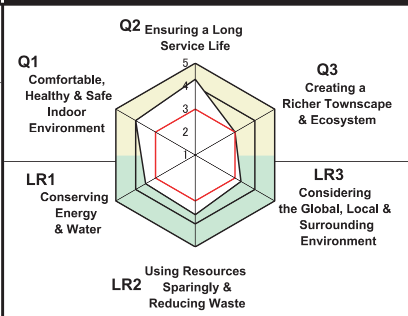
Case 27: Prefabricated steel-frame house built in a suburban area

Location: Seto City, Aichi Prefecture
Land use zone: Category I residential zone
Energy-saving area classification: Zone IV
Structure and construction: Steel-frame/frame unit construction
Number of stories: 2 stories above ground
Site area: 184 m^2
Building area: 67 m^2
Total floor area: 131 m^2
No. of people in household: 4

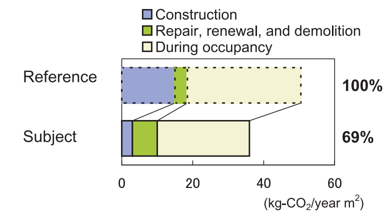
2-1 Building Environmental Efficiency (rank & chart)



2-2 Assessment results of Major categories (radar chart)



2-3 Lifecycle CO_2 (global warming impact chart)

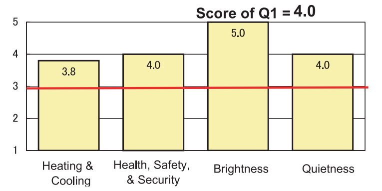


This chart indicates a rough estimate of lifecycle CO2 emission from subject building compared with that from an ordinary residence (reference) as the contents of "Consideration of Global Warming" in LR3.

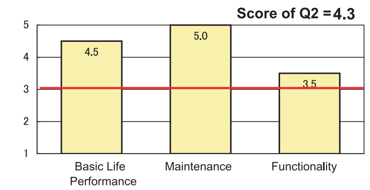
2-4 Assessment results of Medium-level categories (bar charts)

Q Environmental Quality — *Score of Q = 3.8*

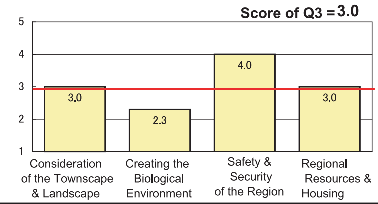
Q1 Comfortable, Healthy and Safe Indoor Environment



Q2 Ensuring a Long Service Life

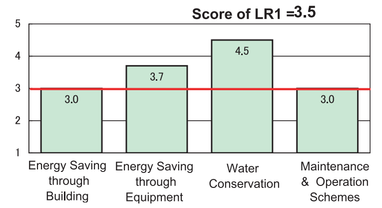


Q3 Creating a Richer Townscape and Ecosystem

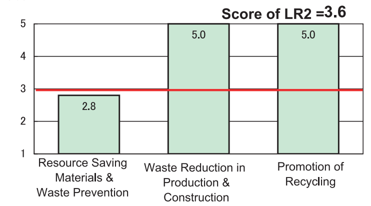


LR Environmental Load Reduction — *Score of LR = 3.5*

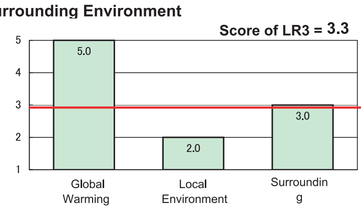
LR1 Conserving Energy and Water



LR2 Using Resources Sparingly and Reducing Waste



LR3 Consideration of the Global, Local, and Surrounding Environment



3 Design Considerations

General	Others
An extended service life is ensured and the amount of energy required for daily life has been reduced. Special consideration was given to security and safety, including the health of the occupants.	

Q1 Comfortable, Healthy and Safe Indoor Environment	Q2 Ensuring a Long Service Life	Q3 Creating a Richer Townscape and Ecosystem
Insulation and mechanisms to block the entry of the sun's rays were installed in the building to reduce the heating and cooling load. Special consideration was given to the building materials used, to protect the health of the occupants. Security was based on crime prevention (CP) standards.	Protection against disasters, such as earthquakes, was ensured. The building frame has a long service life and is easy to maintain. Sufficient space was secured for not only living rooms but also for storage.	The house was designed to harmonize with the surrounding townscape.

LR1 Conserving Energy and Water	LR2 Using Resources Sparingly and Reducing Waste	LR3 Consideration of the Global, Regional, and Surrounding Environment
Reduction of the energy load for heating and cooling as well as hot-water supply was taken into consideration and water-saving equipment was installed.	Recyclable building materials were given preference, and zero emissions from the producing factories and the building site were promoted. In addition, good records of the materials used to construct the building were kept.	

3

Afterword

This research is part of the research output of the Japan Sustainable Building Consortium (Research Committee for CASBEE, chaired by Professor Shuzo Murakami of Keio University), which has been established within the Institute for Building Environment and Energy Conservation through cooperation between industry, government, and academia, with the support of the Housing Bureau of the Japanese Ministry of Land, Infrastructure, Transport and Tourism. We expect the Committee's output to be widely used in the future, thereby making an important contribution to the building of a sustainable society.

As of September 2007 (random order)

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WG on Assessment of Assessment of Resource Efficiency
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The research and development of CASBEE has been carried out as a cooperative project between industry, government, and academia with the assistance of the Japanese Ministry of Land, Infrastructure and Transport. The Japan Sustainable Building Consortium (JSBC) and its affiliated subcommittees provide overall management of CASBEE, and the secretariat has been established within the Institute for Building Environment and Energy Conservation.

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Comprehensive Assessment System for Building Environmental Efficiency
CASBEE for Home (Detached House) - Technical Manual 2007 Edition

First Edition	Published August 31, 2008
Edited by	Japan GreenBuild Council (JaGBC) / Japan Sustainable Building Consortium (JSBC)
Editorial assistance	Housing Bureau, Japanese Ministry of Land, Infrastructure, Transport and Tourism
Published by	Institute for Building Environment and Energy Conservation (IBEC) 2F Zenkyouren Building Kojimachi-kan, 3-5-1 Kojimachi, Chiyoda-ku, Tokyo 102-0083 Japan Tel: +81-3-3222-6693 Fax: +81-3-3222-6696 E-mail: casbee-home@ibec.or.jp URL: http://www.ibec.or.jp/CASBEE
Printed by	RENGO. P. CO.

CASBEE® for Home (Detached House) Technical Manual 2007 Edition

Edited by Japan Sustainable Building Consortium (JSBC) / Japan GreenBuild Council (JaGBC)
Editorial assistance Housing Bureau, Japanese Ministry of Land, Infrastructure, Transport and Tourism
Published by Institute for Building Environment and Energy Conservation (IBEC)

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