EU-Japan Centre
for Industrial Cooperation
日欧産業協力センター

Market Situation and Potentials for Eco-Housing in Japan for EU Companies

September -2024

Rumi Hasegawa

This report has been produced by

ECOS GmbH
Westerbreite 7
49084 Osnabrueck
Germany
Tel.: +49 (0) 541 911 909 90
E-Mail: info@ecos.eu www.ecos.eu

Contents

List of Abbreviations

BEI	Building Energy Index
BSLJ	Building Standard Law of Japan
BRI	Building Research Institute
EEFIT	The Earthquake Engineering Field Investigation Team
SMEs	small and medium-sized enterprises
EPS	Expanded polystyrene
ESG	Environmental, social and governance
GBCI	Green Business Certification Inc
HEMS	Home Energy Management Systems
IBECs	Carbon Neutral for SDGs
JAS	Japanese Agricultural Standard
JIS	Japanese Industrial Standard
JETRO	Japan External Trade Organization
JSBC	Japan Sustainable Building Consortium
LCCM	Life Cycle Carbon Minus
MAFF	Ministry of Agriculture, Forestry and Fisheries of Japan
METI	Ministry of Economy, Trade, and Industry
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
MoEJ	Ministry of Environment Japan
NILIM	National Institute for Infrastructure and Land Management
OECD	Organization for Economic Co-operation and Development
SUFA	Super Functional Air
TIISA	Thermal Insulation Inflatable Solid Air
USGBC	U.S. Green Building Council
ZEH	Net Zero Energy House
ZEB	Net Zero Energy Building

1. Executive Summary

Japan has made two international commitments to address global climate change: to reduce greenhouse gas emissions by 46% until FY2030 and to become carbon neutral by 2050. To achieve this goal, it is necessary to promote energy efficiency and CO_2 reduction in the housing sector, as it is estimated to be responsible for 30% of all CO_2 emissions in Japan. Japanese houses generally have a short life cycle of about 30 years. Furthermore, energy efficiency such as a high insulation system was not mandatory for a long time. Many developed countries have been promoting energy-efficient constructions and decarbonized homes as part of their efforts to combat global warming. They have made it mandatory for new homes and other buildings to be highly insulated. However, Japan was the only country in the G7 where no performance standard for the insulation of houses existed, and some built-for-sale houses even ignored insulation performance to keep costs down.

In recent years, insulation and energy efficiency in housing has been attracting more attention in Japan due to the global energy crisis and climate change. Japan's summer heat waves are increasing in severity, while in winter, snowfall is decreasing, causing the cancellation of snow festivals and the closure or suspension of ski resorts. With electricity and gas prices rising, partly due to soaring natural gas and oil prices, insulated homes with high energy utilization efficiency are in demand. Against this background, Japan's energy efficiency and conservation policy for housing has reached a turning point. The government revised the Energy Efficiency Act to make energy efficiency standards mandatory from 2025 in residential buildings. Although houses were exempt from the obligation to comply with energy efficiency standards, it was decided to include them in new construction from 2025. In addition, from FY2030 onwards, new homes and buildings will be required to meet the Net Zero Energy House (ZEH) and Net Zero Energy Building standards. The law mandates that a level of energy efficiency and conservation performance that meets these standards is ensured. The relevant ministries, MLIT, METI, and MoEJ, launched a subsidy campaign for households to promote eco-housing and enhance the awareness of energy efficiency. The number of ZEH houses has been steadily increasing, however, the number of units is much lower than that of Germany. Therefore, the market is expected to grow in the next years and offers interesting opportunities for European technology providers.

European companies have various channels for entering the Japanese market, including wholesale companies and trading companies that have strong, long-year networks. They could be the first contact point for the European companies in the distribution channel. It is generally difficult for European companies to reach retailers or end users directly without a basis in Japan. To find suitable distribution partners in Japan, contacting industry associations, trade organizations like the Japan External Trade Organization, or participating in trade fairs in Japan could be helpful.

Regulations and certifications in Japan are different from those in Europe. As a country prone to natural disasters, Japan has developed its regulations such as fire and earthquake protection. The Sick Building Issue (meaning houses with toxic materials such as asbestos or formaldehyde) has also become a major concern in the country since the 1980s. Japan developed its certification system to address this issue. This kind of information is quite useful for foreign companies to plan the schedule of market entry strategy in Japan.

The future of eco-housing in Japan looks promising, with substantial potential for growth driven by several factors. The Japanese government has set ambitious targets, aiming to make Net Zero Energy Houses the standard for new constructions by 2030, which will likely propel the adoption of sustainable housing solutions. There is increasing awareness and demand for energy-efficient and eco-friendly designs, including renewable energy sources and

advanced insulation materials and techniques. Japan's technological innovation is also a significant driver, with companies developing advanced solutions like energy-efficient lighting and air conditioning systems. Additionally, there are opportunities for European companies with complementary energy efficiency technologies to enter the Japanese market.

However, foreign companies entering Japan's eco-housing market may face significant challenges, including established local networks, long decision-making processes, and a consumer focus on cost over sustainability. Navigating Japan's unique certification processes and overcoming high initial costs require local partnerships. Additionally, a lack of consumer awareness about sustainability and difficulties in winning public contracts necessitate strategic collaborations.

European companies entering Japan's eco-housing market should focus on energy efficiency and innovative technologies, emphasizing long-term benefits with concrete calculations. Utilizing support services like the EU-Japan Centre through the Green Mission to Japan, and solutions tailored to Japan's climate can help the business development as well. Significant investments in time, resources, and reliable local partnerships are crucial, as is employing skilled interpreters. Demonstrating local reference projects and building strong customer relationships are also key strategies. Additionally, participating in trade fairs, creating detailed PR materials, and highlighting the European origin of products can enhance market entry and success.

2. Scope of Report

In this report, eco-housing is defined as residential buildings that focus on reducing energy consumption and increasing energy efficiency to achieve sustainability. Renewable energy integration systems, Net Zero Energy Houses (ZEH), efficient ventilation systems, and Home Energy Management Systems (HEMS) can achieve this. The use of sustainable and eco-friendly building materials also contributes to enhancing energy efficiency and promoting sustainability.

This report is aimed at small and medium-sized companies in Europe that offer innovative technology in the eco-housing sector and plan to enter the Japanese market. It provides a comprehensive overview of the Japanese eco-housing market, including current trends, key players, distribution channels, and potential opportunities and challenges for European companies.

Chapter 3 briefly summarizes some basic information and relevant socio-geographic and climate related facts in Japan for the building sector.

Chapter 4 explains the political framework conditions in Japan and discusses important regulations for the eco-housing sector.

Chapter 5 gives an overview of the eco-housing market in Japan, including market size, trends, distribution channels, and relevant regulations.

In Chapter 6, general technology trends are explained and key technologies in housing sectors are shortly introduced. Six important fields are highlighted here: insulation materials, windows, Smart Housing, cement and further construction materials, paints and plasters, and HVAC (heating, ventilation, Air Conditioning).

The report concludes with a short analysis of the business opportunities, main challenges, and key success factors (chapter 7).

The report is based on extensive desk research of relevant publications and media, including publications by Japanese ministries, government bodies, and research institutions in the Japanese language. Furthermore, information sources such as specialist journals, economic journals, company reports and websites, and statistical websites were integrated to complement the study.

3. Country Profile

Japan's total area is approximately 37.80 million hectares, of which 32% is inhabitable. Industrial areas account for only 5% of all land in Japan. This leads to extremely high population density compared to other countries (The Building Center of Japan, 2022).

Table 1-1-1: Comparison of Habitable Areas (FY2020)

	Japan	Korea	Indonesia	Malaysia	Germany	France	U.S.A.
A. Land area (millions of hectares)	3,646	975	18,775	3,286	3,489	5,476	91,474
<Forest area> (millions of hectares)	2,494	629	9,213	1,911	1,142	1,725	30,980
B. Habitable land area (millions of hectares)	1,152	346	9,562	1,374	2,347	3,750	60,495
B /A (%)	32	35	51	42	67	68	66
Population (millions)	125.3	51.3	273.5	32.4	83.8	65.3	331.0

Note: Land area = Total area – bodies of water, Habitable land area = Land area – forested area
Source: Ministry of Land, Infrastructure, Transport and Tourism (MLIT), *White Paper on Land* (land area of Japan, developed land area: 1.97 million hectares), Statistics Bureau, Ministry of Internal Affairs and Communications, *Sekai no Tokei* [World Statistics] (Land and Climate) (populations)

Table 1: Comparison of Habitable Areas (Source: The Building Center of Japan, 2022)

Japan's climate is diverse and varies significantly across the country due to its extensive north-south span and geographical features. The country experiences four distinct seasons, ranging from subarctic in the north to subtropical in the south. Conditions also differ between the southern side facing the Pacific and the northern side facing the Sea of Japan. Northern Japan has warm summers and freezing winters, with heavy snowfall on the northern side and in mountainous areas. Eastern Japan experiences hot, humid summers and cold winters, with heavy snowfall on the Sea of Japan side and in mountainous regions. Western Japan endures hot, humid summers, with temperatures sometimes exceeding 35 degrees Celsius, and moderately cold winters. Okinawa and Amami enjoy a subtropical oceanic climate, characterized by hot, humid summers—though temperatures rarely exceed 35 degrees—and mild winters.

Figure 1: general Information on the Climate of Japan (Source: Japan Metrological Agency)

4. Political framework conditions

Japan has set a goal of net zero emissions by 2050. To achieve this goal, the Ministry of Economy, Trade, and Industry (METI), the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), and the Ministry of the Environment (MoEJ) are working together for energy-saving and CO_2 reduction in housing. Japan's energy policy aims to decarbonize the building sector, which accounts for 30% of Japan's energy consumption, through stricter efficiency codes for new buildings, financial support for retrofits, and encouraging low-carbon construction materials such as wood. In the „Plan for Global Warming Countermeasures" decided by the Cabinet in October 2021, the government set goals for 2030 and 2050 as follows (MLIT, 2023):

By FY2050

- Secure the level of Net Zero Energy houses and buildings on stock average
- Introduce renewable energy in common houses and buildings if it is reasonable

By FY2030

- Require the level of Net Zero Energy for newly constructed houses and buildings
- Install solar power generation equipment for 60% of newly constructed detached houses

In 2015, the Act on the Improvement of Energy Consumption Performance of Buildings (Building Energy Efficiency Act) was newly established. This Act provides for (1) regulatory measures for mandatory compliance with energy efficiency standards for large-scale non-residential buildings, (2) incentive measures such as a labeling system displaying compliance with energy efficiency standards, and the exception of floor-area ratio regulation for certified buildings (MLIT, 2016).

The revised Building Energy Efficiency Act enforced in 2022 requires compliance with energy efficiency standards for all newly constructed buildings, including residential buildings, from 2025 onwards. For non-residential buildings from 300m^2 to more than 2000m^2, the mandatory compliance began ahead of time in April 2017(MLIT, 2023). Under the revision, both nonresidential and residential buildings must conform to a certain level of energy efficiency and conservation performance from April 2025. These mean (1) the insulation performance grade 4, and (2) the primary energy consumption grade 4, which is the amount of primary energy consumed (MLIT).

Primary energy consumption grade	
Grade 5	BEI ≤ 0.9
Grade 4	BEI ≤ 1.0
Grade 3	-
Grade 2	-
Grade 1	-

Thermal equivalence index (TEFI)	
Grade 4	U_A value ≤ 0.87 (Energy Efficiency Standards)
Grade 3	U_A value ≤ 1.54
Grade 2	U_A value ≤ 1.67
Grade 1	-

Table 2: Establishment of a higher grade for energy-saving performance in the Housing Performance Indication System 住宅性能表示制度における省エネ性能に係る上位等級の創設(Source: MLIT)

The energy efficiency standards will be upgraded to the level of ZEH/ZEB standards by FY2030 at the latest. The revised act will also strengthen the energy efficiency display system for residential and non-residential buildings from FY 2024, including existing buildings when they are sold or leased.

At the same time, the government plans to promote retrofitting of existing buildings through financial incentives like subsidies, tax cuts, and low-interest loans, however, there are no mandatory regulations for now. For instance, MLIT provides partial financial support of up to 50 million yen (Subsidy rate 1/3) for energy-saving renovation and barrier-free renovation work conducted by private enterprises (MLIT, 2023).

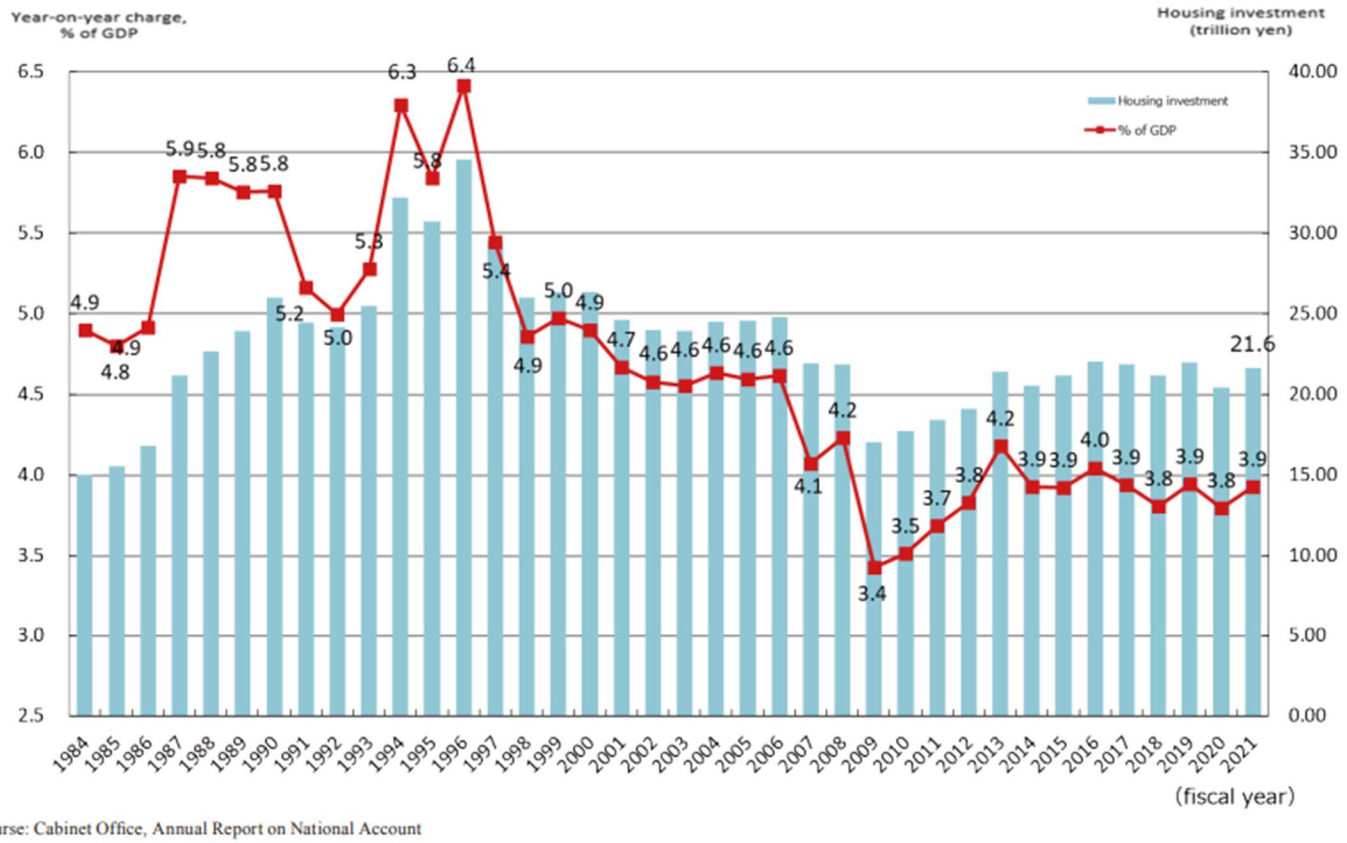
Japan recognizes the importance of using sustainable low-carbon materials like wood in construction to reduce embodied carbon emissions from buildings. Since the Act on the Promotion of the Use of Wood in Public Buildings entered into force, the percentage of public buildings made of wood has been increasing (29.4% for low-rise public buildings in 2021). However, the rate of wood construction in the middle-rise to high-rise buildings and low-rise non-residential buildings is still low. To expand the use of wood materials in these buildings, the Forestry Agency supports developing wood-resistant materials (Forestry Agency, 2023). In 2021, the "Agreement on the Use of Wood in Buildings" was established. Business operators who will be building owners can conclude this agreement with the national government or local municipalities to realize the concept of using wood in buildings.

5. Overview of the eco-building market

a. Market size

Japan is a country of mostly new buildings, and scarce land in urban areas is the most fundamental factor defining the Japanese housing market. The country has a "disposable house" culture, where homes often depreciate completely in about 30 years and are replaced. This frequent turnover allows for more opportunities to build more modern structures. Furthermore, given Japan's geographical and geological position, buildings are subjected to many natural pressures in terms of temperature and seismic activity, which could make the conversion of older buildings difficult (EU-Japan Center, 2023). Total housing Investment in Japan rose dramatically during the bubble economy in the 1980s. After the crash of the bubble economy, investment decreased to twenty-five trillion yen. Due to the financial crisis in 2007 and consumer tax enhancement in 2014, the scale of the investment has remained at around 20 trillion yen (approx. 4% of the national GDP).

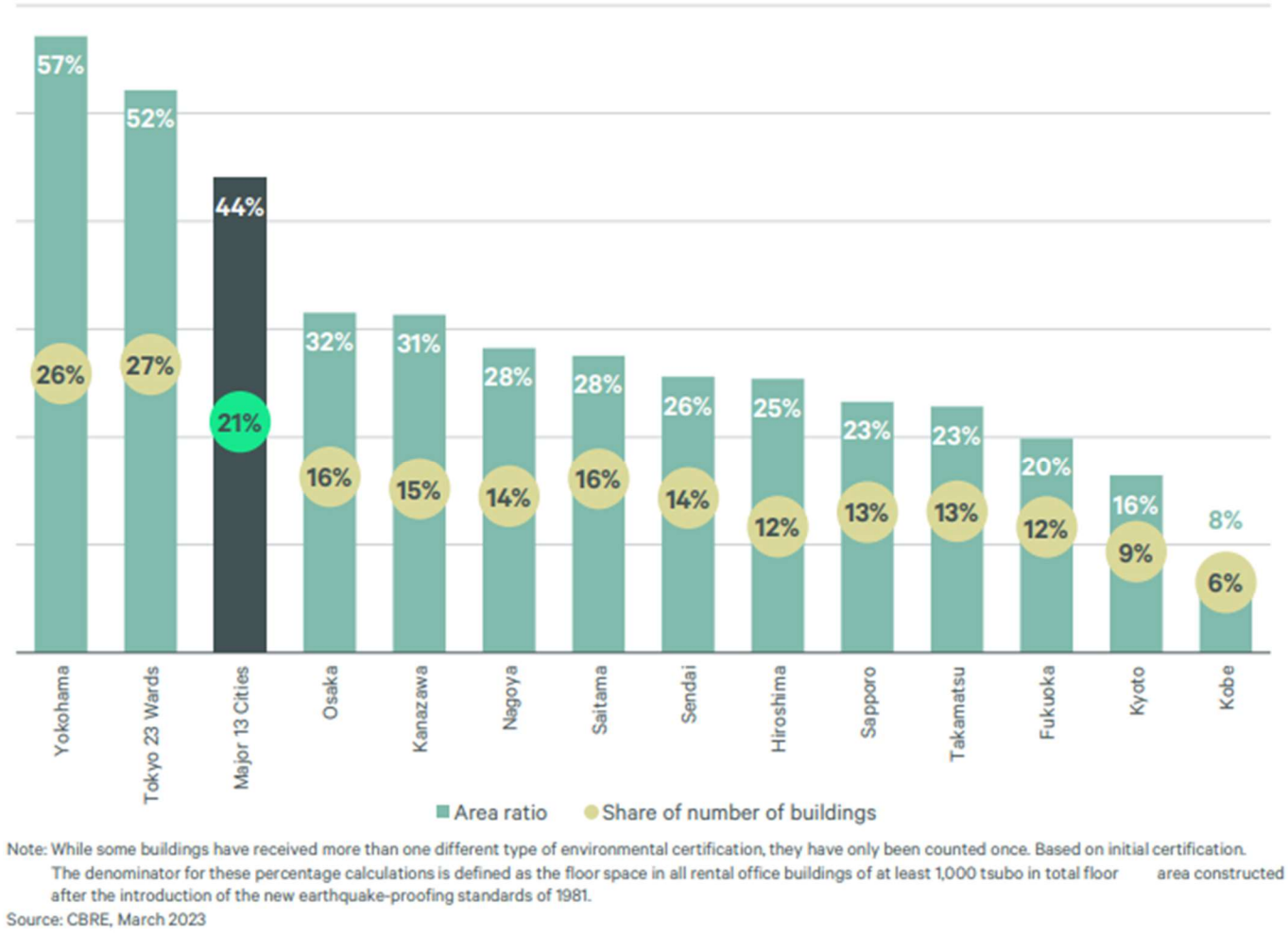
Figure 2-3-4: Housing Investment (nominal)



Sourse: Cabinet Office, Annual Report on National Account

Figure 2: Housing Investment in Japan (Source: Center for Better Living,p 19)

In 2023, the house renovation market grew to 7.35 trillion yen (Nikkei Shinbun), a 0.6% increase from the previous year, driven by greater investment in housing and renovations amid the "with Corona" lifestyle. The eco-housing market has also seen recent growth, with expectations for further expansion. Notably, 44% of office building floor space in 13 major cities was environmentally certified in early 2023, a trend likely to continue due to the benefits for both landlords and tenants (CBRE, 2024).



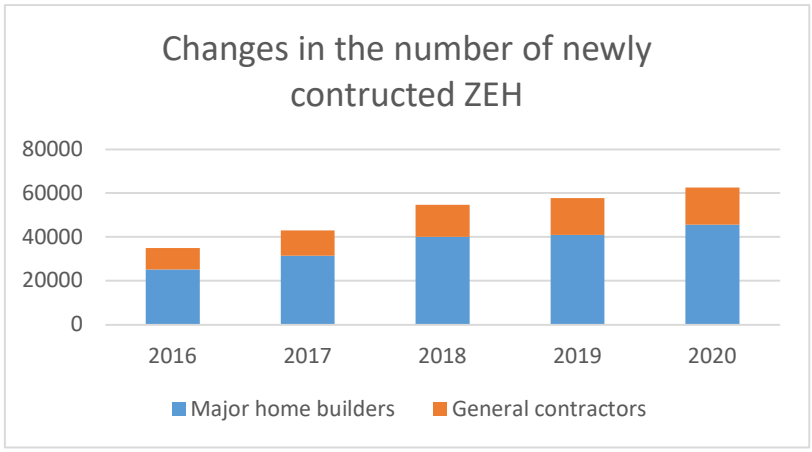
Note: While some buildings have received more than one different type of environmental certification, they have only been counted once. Based on initial certification. The denominator for these percentage calculations is defined as the floor space in all rental office buildings of at least 1,000 tsubo in total floor area constructed after the introduction of the new earthquake-proofing standards of 1981.
Source: CBRE, March 2023

Figure 3: Green building percentages (Source: CBRE, 2023)

The number of supplied units of ZEH has steadily increased from 35.000 in FY2016 to 63.000 in FY2020 (MLIT, 2022). The percentage of ZEH among new custom-built houses was about 24% in 2021 (MLIT, 2022).

Progress, however, is still slow and it is uncertain whether the trends in emissions reductions in the housing sector will be enough to reach net-zero by 2050. In 2019, among more than fifty million housing units in Japan, only 6% of them met the current insulation performance standards, and 38% showed a UA value (heat transfer coefficient) of nearly 0.9. This placed the Japanese housing market far behind other OECD member states, where UA values typically ranged between 0.4 and 0.3. The market for thermal insulation materials has increased in the last years alongside a rise in demand for super-insulated houses which aim for a UA value of 0.6 (EU-Japan Center, 2023). According to Yano Research Institute, in FY2022, the residential insulation market (based on manufacturer shipments) was estimated to decrease by 0.9% year-on-year to 345,336 tons on a volume basis and increase by 4.5% year-on-year to 181.8 billion yen on a value basis (Yano Research Institute, 2023).

Based on current projections, 3.13 million ZEH stock units will not be built in time for the policy targets in FY2030. Considering that the new housing numbers are projected to decrease to 460,000 in FY2040, the number of ZEH housing units will also likely stagnate by FY2040 (Nomura Research Institute, 2021). The renovation market is expected to increase to some extent or remain flat until 2040. The annual market size will be 6 to 7 trillion yen (Nomura Research Institute, 2021).



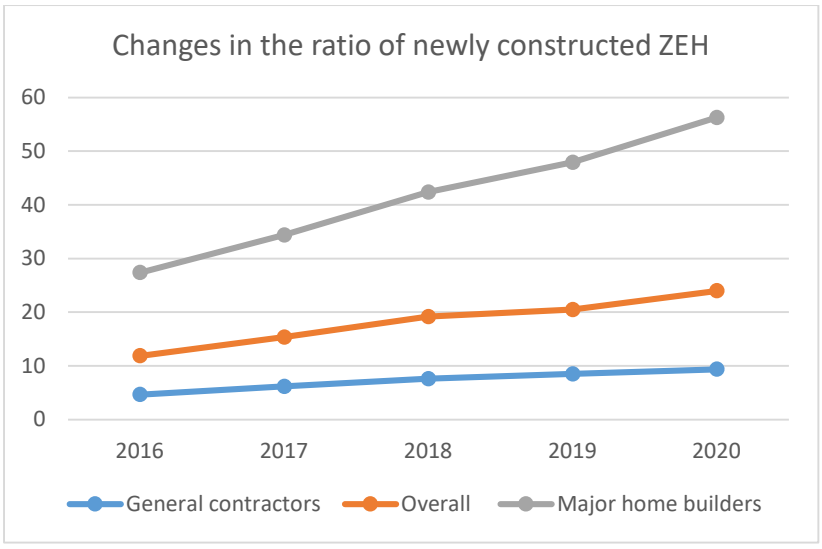


Figure 4: Changes in the number of newly constructed ZEH and changes in the ratio of newly constructed ZEH (Source: Policy Bureau, Ministry of Land, Infrastructure, Transport and Tourism,2022)

b. Market trends

Traditionally, Japanese houses were constructed using wood. In 1963, 94% of residential buildings were made from wood. However, by 2018, this number had significantly decreased to 56%, while the percentage of non-wooden houses increased to 43.3%. Especially in the private housing sector, prefabricated houses play an important role in Japan. According to the statistics from the MLIT, out of 860,000 new housing units in 2022, 112,000 were prefabricated (13%). Of these, 10,000 were wooden houses, 99,000 were steel-framed, and 2,000 were reinforced concrete (MLIT, 2023).

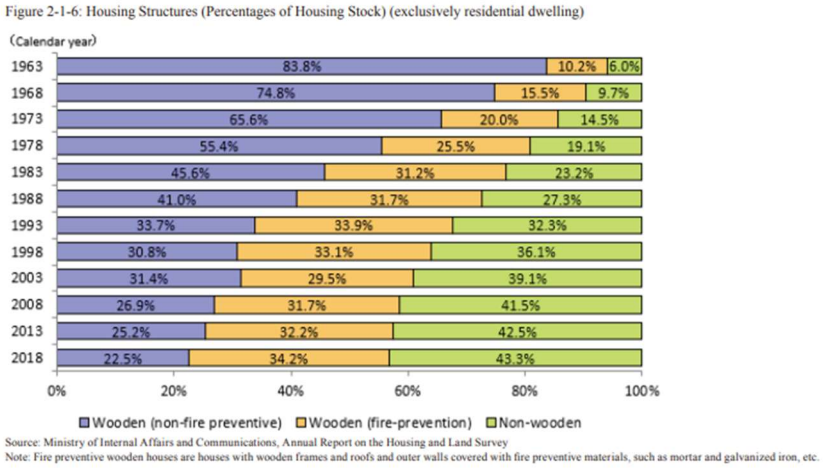
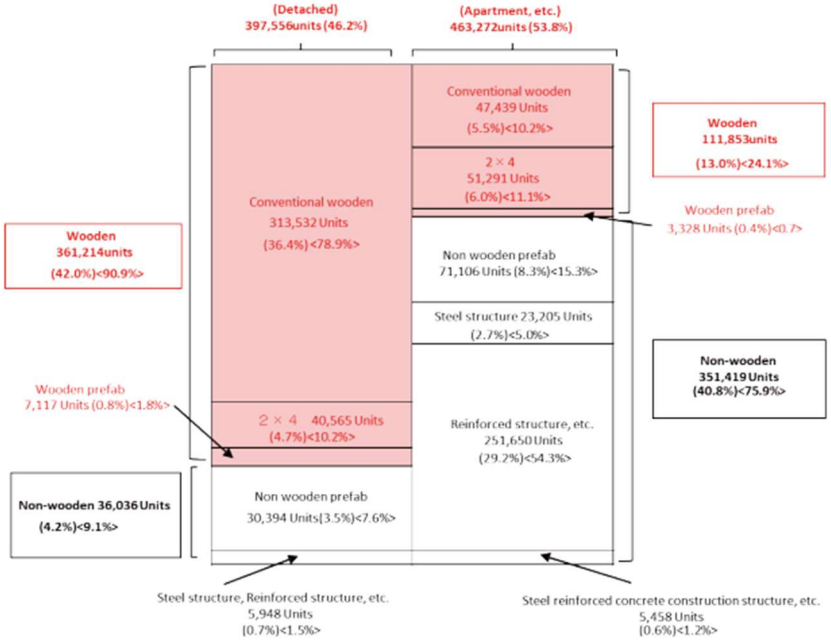


Figure 5: Housing structures (Percentages of Housing Stock) (Source: Center for Better Living)

An analysis of housing structure in FY 2022 shows that detached houses accounted for 46.2% and apartment housing units 53.8%, respectively. There were 473,000 (55%) construction starts for wooden houses. The number of non-wooden units was 388,000 (45%).



Notes: Figures in ( ) are percentages of total housing units. Figures in < > are percentages of total detached units, apartments, etc. The composition ratio is rounded to the first decimal place, so the total is not necessarily 100.

Source: Ministry of Land, Infrastructure, Transport and Tourism, Statistical Survey of Housing Construction Starts, 2022

Figure 6: Types and Structures of Newly Build Houses (FY2022), Building Research Institute, 2024

Life Cycle Carbon Minus (LCCM) Houses and Zero Energy Houses are currently needed to fulfill sustainability goals envisioned by the Japanese government. LCCM Houses are houses that result in a negative life-cycle CO_2 emission balance. The construction, usage, and waste disposal should emit the least amount of CO_2. Sustainable energy is created by using solar power. However, reduction of energy consumption should not result in unsafe, uncomfortable,

and inconvenient living conditions. LCCM housing certification is provided by the Institute for Building Environment and Energy Conservation. A tool for evaluating LCCM exists as well. The design concept of these housing types was developed by a joint research project of the Building Research Institute (BRI), the National Institute for Infrastructure and Land Management (NILIM), and the Japan Sustainable Building Consortium (JSBC). It consists of a multilayer structure to create zones of distinctive characteristics and striped plan configurations for zones for different activities performed in the house, piled up sectional configuration with openings for natural lighting, and passageways for people and air. Furthermore, the building mode can be adjusted to different seasons and lifestyles by opening and closing layers. Natural energy is used by having an open facade towards the south and ventilation towers on the north to let in light and fresh air. Lastly, the rooms in the house are arranged in a way that makes the conditions suitable for the specific activities performed in the room (Building Research Institute, 2024).

Another important building type to reduce CO_2 emissions is Zero Energy Houses (ZEH). They should require as little energy as possible and have high thermal insulation standards. Included in the ZEH series, which was necessary to adapt to the diversity of construction site conditions in Japan, are also ZEH Plus and ZEH Oriented. To be specified as ZEH Plus, the house must meet the criteria of ZEH, have energy savings of more than 25%, and take two out of three measures regarding the self-consumption of renewable energy. These measures include further enforcement of thermal insulation and more intelligent energy management systems. For example, turning on eco-mode when overall energy usage in the house reaches a certain level by showing how much electricity is used for which electronic device, or using electricity generated by photovoltaic power generation equipment for charging electric vehicles (Center for Environment and Energy Conservation, 2022). ZEH Oriented is an option for urban areas that might not be able to produce as much renewable energy as in other sites. These advanced houses built at small sites in highly populated residential areas need to meet the high thermal insulation requirements, have energy saving of more than 20% without renewable energy and they are not required to install photovoltaic. By 2020, more than half of newly constructed houses will be ZEHs since the popularity of ZEH became one of the main political measures in the “Plan for Global Warming Countermeasures”. As of now, 6,000 construction companies have been registered as ZEH builders (Akimoto, 2017).

Eco housing has become popular for newly constructed houses and renovation of existing houses. In the first quarter of 2024, about 6% of building renovations were for energy efficiency. The majority of renovations were made for the renewal and repair of deteriorated or broken parts (93%) (MLIT). The Japanese government has started the eco housing campaign which provides grants for a renovation that uses subsidized products. For energy efficiency, these four are the main ways of renovation, using energy creation and utilization of renewable energy, reducing energy consumption, solar shading, and improving thermal insulation performance. Improving thermal insulation performance, especially for windows and doors, is particularly promoted in the government campaign. The indoor environment will change greatly by replacing windows with high thermal insulation performance because 70% of the heat inflow from the outside in the summer comes from windows and 60% of the heat outflow to the outside in winter comes from windows(LIXIL). Furthermore, attaching interior windows is easier in condominiums since the windows of condominiums are often defined as common areas. Still, if it is an interior window, obtaining permission for construction as an interior renovation is easier than a common area renovation. The grant budget of the government campaign for this is 135.0 billion yen and 142,303 houses have already installed eco-efficient windows or doors which evaluates 32% of the grant budget as of 10.09.2024 (Eco-Home Support Project Secretariat).

c. Distribution Channels

Japan's distribution system for building products is complex and multi-layered, often involving multiple intermediaries between manufacturers and end-users. This complexity can make it difficult for foreign companies to navigate and reach retailers directly. In addition, the system emphasizes long-term relationships and cooperation between different layers of the distribution chain. A foreign company may find it challenging to establish these relationships quickly. Seeking partnerships with established wholesalers and trading companies is more effective for foreign companies than attempting to reach retailers or housing companies.

Trading companies *(Shosha in Japanese*): These could provide valuable support for foreign companies entering the eco-housing market. General trading companies such as Sumitomo, Marubeni, and Itochu have subsidiaries specializing in building materials such as Itochu Kenzai Corporation and SMB Kenzai, however, there are also individual trading companies that specialize in building materials such as ABC Trading or Japan Kenzai.

Housing companies: Some large housing companies such as Sekisui House or Misawa Homes directly procure materials, bypassing traditional distribution channels. They may work closely with specialized trading companies like Itochu Kenzai Corporation, which offer a wide range of home-related products and services. These housing companies build prefabricated housing on a large scale.

Wholesalers: these can be one of the first points of contact for foreign companies entering the market in Japan. Some European companies, for example, Sto (Germany) or Saint Gobain (France), have their branches/agents in Japan. These companies, however, sell products exported from their headquarters.

Retailers: Retailers are a part of the multi-layered distribution system, serving as a point of contact for selling building materials to end users and smaller construction firms.

E-commerce is growing in Japan and could be a channel for eco-housing products. In addition to Amazon, Japanese E-Commerce markets such as Rakuten and ASKUL have a large presence in the online market. Products are being sold only in the Japanese language.

Trade Fairs are a good opportunity for foreign companies to find distributors in Japan. Besides the **Japan Home+ Building** show, the largest domestic trade fair for residential construction, "**Japan Build**" can be a gateway to the Japanese and Asian markets as well. This is Japan's first exhibition for high efficiency building materials.

Exhibition	**Japan Home+ Building show**
Website	https://www.jma.or.jp/homeshow/tokyo/
Date	20.11.2024-22.11.2024
Venue	Tokyo Big Sight
Participants	26011 visitors

Exhibition	**Japan Build**
Website	https://www.japan-build.jp/tokyo/ja-jp/about.html
Date	11.12.2024-13.12.2024
Venue	Tokyo Big Sight
Participants	560 Exhibitors (2023)

d. Main Players

When considering entering the Japanese market, it is useful to get information on regulations and market trends from relevant ministries or industrial associations.

Political institutions

At the administrative level, the following three ministries are key players in setting political frameworks:

- Ministry of Land, Infrastructure, Transport and Tourism (MLIT)
  The Ministry of Land, Infrastructure, Transport and Tourism has jurisdiction over the Building Standard Law. The Building Energy Conservation Law was made with the Ministry of Economy, Trade, and Industry. MLIT also has jurisdiction over areas related to building safety, such as fire prevention measures. The ministry is responsible for strategy and planning for the construction industry, and the collection of statistics.
  https://www.mlit.go.jp/en/index.html

- Ministry of Economy, Trade and Industry (METI)/Agency for Natural Resources and Energy
  The Agency for Natural Resources and Energy, an organization under the METI, makes the Basic Energy Concept of Japan and ZEH Roadmap.
  https://www.enecho.meti.go.jp/en/

- MAFF/Forestry Agency
  The Forestry Agency, under the Ministry of Agriculture and Forestry and Fishery, is responsible for promoting wood utilization in buildings.
  https://www.rinya.maff.go.jp/e/index.html

- Ministry of the Environment (MoE)
  The Ministry of Environment is responsible for policies in energy efficiency.
  https://www.env.go.jp/en/

Procurement information

Public tenders are publicized in regional magazines and the official government journal "Kanpo." Engaging in public initiatives yields favorable feedback, increasing the likelihood of receiving additional project awards. To participate in the Kanpo tenders, the company must be listed as “qualified”. This could be done, for example, via a Japanese branch. In addition, so-called “procurement seminars” are organized annually in English for the respective fiscal year. A translation of “Kanpo” is possible via the Japan External Trade Organization (JETRO).

- Public Works Procurement Information Service (Information about tenders in Japanese)
- Private Finance Initiate-PFI (not specifically on construction fields, Information about projects in Japanese)

Industry Associations

- Japan Federation of Construction Contractors
- The Building Center of Japan
- Japan Association for Earthquake Engineering
- Japan Housing and Wood Technology Center
- Japan Sustainable Building Consortium

Furthermore, the following points of contact can be helpful, when expanding a market regarding eco-housing in Japan:

- Research Institute of Construction and Economy (Independent research institute for the construction industry under the MLIT)
- Japan Federation of Construction Contractors (Association of General Contractors)

Private companies

Various big construction companies have zero-emission houses in their product range. Furthermore, these companies are diversifying into residential units in larger buildings to make them more energy-efficient, e.g., with better insulation, and windows (GTAI, 2024).

Housing companies

Daiwa House	Company	Daiwa House
	HQ	3-3-5 Umeda, Kita-ku, Osaka 530-8241, Japan
	Website	https://www.daiwahouse.com/English/about/
	Products	Detached houses, rental housing, condominium, and commercial buildings etc. Urban and residential area development businesses, real estate development and environment and energy business.

	Company	Sekisui Daiwa House
	HQ	1-1-88, Oyodonaka, Kita-ku, Osaka, 531-0076, Japan

SEKISUI HOUSE	Website	https://www.sekisuihouse.co.jp/english/
	Products	Detached houses, rental housing and commercial buildings, architectural/civil engineering, rental housing management, etc. It has as of the end of March 2022 already built a cumulative total of almost 70,000 net zero energy houses and broke the record with a 92% net zero energy house in FY 2021.

MISAWA	Company	Misawa Home
	HQ	2228-5 Nagasaka-cho Nagasaka-kamijo, Hokuto-shi, Yamanashi, Japan
	Website	https://www.misawa.co.jp/en/group/
	Products	New home and rebuilding, House and land packages, land utilization, Rental management, Renovation, Real estate services, Property sales, facility construction, Apartments, Train station development projects and International Business in US, Australia, and Asia.

トヨタホーム (人生をごいっしょに。 Sincerely for You)	Company	Toyota Home
	HQ	23-22-1, Izumi, Higashi-ku, Nagoya 461-0001, Japan
	Website	https://www.toyotahome.co.jp/corporate/
	Products	Detached Housing (Steel frame unit construction method, steel frame construction method, wooden houses), Rental Housing, Condominium, Urban Development, Stock Business

Construction companies

OBAYASHI	Company	Obayashi Corporation
	HQ	Shinagawa Intercity Tower B, 2-15-2, Konan, Minato-ku, Tokyo 108-8502, Japan
	Website	https://www.obayashi.co.jp/en/

	Products	Products Domestic and overseas construction works, regional development, urban development, ocean development, environmental improvement, other construction-related development

KAJIMA	Company	KAJIMA CORPORATION
	HQ	3-1, Motoakasaka 1-chome, Minato-ku, Tokyo 107-8388, Japan
	Website	https://www.kajima.co.jp/english/welcome.html
	Products	Construction (Civil Engineering and Building Construction), Real Estate Development, Architectural Design, Civil Engineering Design, Engineering and Other business including management, consulting, and real estate business

TAISEI For a Lively World	Company	TAISEI CORPORATION
	HQ	1-25-1, Nishi-Shinjuku, Shinjuku-ku, Tokyo 163-0606, Japan
	Website	https://www.taisei.co.jp/english/
	Products	Building construction, civil engineering, real estate development

TAKENAKA	Company	TAKENAKA CORPORATION
	HQ	1-13-4, Hommachi, Chuo-ku, Osaka, Japan
	Website	https://www.takenaka.co.jp/takenaka_e/
	Products	Planning and Design, Architectural Design, Production, After-Sale Service, Development Business, Technological Development and Engineering

Today's Work, Tomorrow's Heritage SHIMIZU CORPORATION SHIMZ	Company	SHIMIZU CORPORATION
	HQ	2-16-1 Kyobashi, Chuo-ku, Tokyo 104-8370, Japan
	Website	https://www.shimz.co.jp/en/

	Products	Construction, Architecture, Civil Engineering and Property Services (General Construction Business), Real Estate Development

Material Companies

YKK AP Build a Better Society	Company	YKK AP Inc.
	HQ	1, Kanda Izumi-cho, Chiyoda-ku, Tokyo, 101-0024, Japan
	Website	https://www.ykkapglobal.com/en/
	Products	Residential Products (windows, shutters, doors, wood flooring, insulating glass), commercial products (windows, doors, curtail wall, steel products) and others (aluminum profile products, manufacturing machinery, architectural parts)

Trading companies

SMB Kenzai Co.,Ltd.	Company	SMB Kenzai Co., Ltd.
	HQ	SUMITOMO FUDOSAN TORANOMON TOWER 2-2-1, Toranomon, Minato-ku, Tokyo 105-0001, Japan
	Website	https://www.smb-kenzai.com/en/
	Products	Wooden Products, Housing Materials, Construction Engineering & Materials, Wooden Structures

ITOCHU	Company	ITOCHU KENZAI CORPORATION
	HQ	1-4, Nihonbashi-Odemmancho, Chuo-ku, Tokyo 103-8419, Japan
	Website	https://www.ick.co.jp/en/
	Products	Housing Materials, Wood Materials, Wood Products, Construction Materials and Construction Work

e. Related Laws and Regulations

i. Overview of regulations

The Building Standard Law, which is obligatory to all buildings in Japan and from the time of construction to the time of destruction or demolition, was enacted in 1950 to protect the life, health, and property of people by providing minimum standards for the site, construction, equipment, and use of buildings. In that way, it can further public welfare. Additional regional standards exist to prepare for snow accumulation, earthquakes, and other conditions. Furthermore, it regulates maintenance and periodic inspections of buildings as well. Whenever a certain building is constructed, extended, rebuilt, or relocated, the owner of the building must apply for and receive a building confirmation form from the regional building control. To provide accessible buildings, in particular hospitals, theaters, assembly halls, department stores, hotels, and homes for the aged, it is necessary to comply with accessibility and mobility standards when undertaking certain types of construction work of a special specified building with a total floor area of 2,000 square meters or more. The Building Standard Law also has regulations for energy efficiency. The METI and the MLIT provide guidelines on the design and construction of buildings for non-residential buildings and houses. Building owners must ensure that the building conforms with the "Building Energy Efficiency Standards" which means the insulation performance grade 4 and the primary energy consumption grade 4 because these will be obligatory from April 2025(refer to p9).

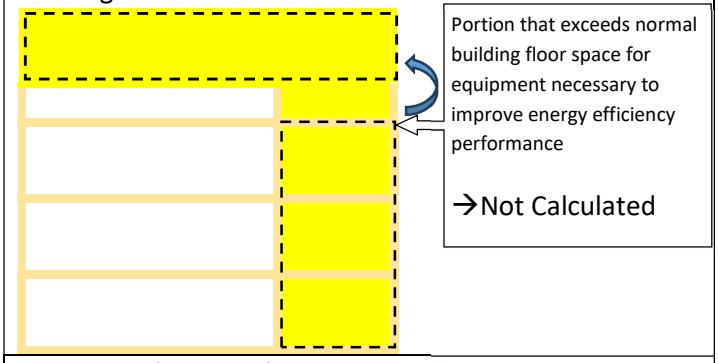
Mandatory Regulation	**Voluntary Regulation**
The Building Standard Law (p22) -Applies to all buildings in Japan -Basic Rules for Construction	**Building Energy Efficiency Act** (p23) Labeling system for Energy Efficiency (BELS)
Building Energy Efficiency Act (p9) -Mandatory compliance with energy efficiency standards grade 4 -Mandatory compliance with conservation performance grade 4 (Both from 2025 onwards)	**Building Energy Efficiency Act** (p9) Exception of floor-area ratio regulation for certified buildings 
Regional Standards (p22) -regulates maintenance, periodic inspections of buildings and preparation for natural conditions in the specific region	
Building Standard Law (p28) -made it mandatory to grade F-stars according to formaldehyde emission rate with JAS (Japanese Agricultural standard) and JIS (Japanese Industrial standard)	**Other certifications for green buildings** CASBEE, BL Component Certification System, DBJ Green Building Certification, LEED, WELL

Table 3: Overview of housing regulation in Japan

Different certifications exist for 'green' buildings in Japan: CASBEE, BELS, BL Component Certification System, DBJ Green Building Certification, LEED, WELL, co-symbiosis housing certificate, and environmentally friendly building material registration.

CASBEE (Comprehensive Assessment System for Built Environment Efficiency), developed by academia, industry, and local governments in 2001, "is a method for evaluating and rating the environmental performance of buildings and the built environment" (JSBC & IBEC, 2024). Organized by JSBC (Japan Sustainable Building Consortium) and Japan Green Build Council (JaGBC), CASBEE can assess buildings regarding design to renovation. Comprehensive assessment throughout the life cycle of the building, assessment of the Built Environment Quality and Built Environment Load and lastly Assessment based on the newly developed Built Environment Efficiency (BEE) indicator are the three principles on which the CASBEE assessment tools were developed on. The **BEE**, as an assessment indicator for CASBEE, is the result of the equation environmental quality of the building divided by the environmental load of the building. BEE makes the building environmental performance assessment result simpler and clearer. The buildings are then ranked from S to C, with S being the most sustainable building (JSBC & IBEC, 2024).

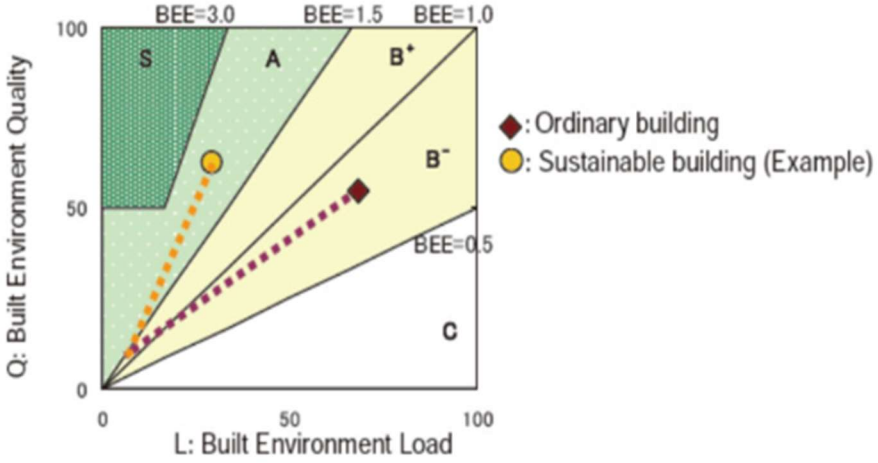


Figure 7: Environmental labeling based on Built Environment Efficiency (BEE)

The Building Energy Efficiency Labeling System (BELS) is a reference system for evaluating the energy-saving performance of non-residential buildings. BELS is a third-party evaluation. From April 2016, real-estate companies and others are encouraged to display the energy-saving performance of their buildings. Buildings can receive one to five stars. The more stars, the better the energy-saving efficiency of that building (The Association for Evaluating and Labeling Housing Performance, 2002).

The Better Living (BL) Component Certification System provides an easy understanding of good-quality housing components. The Center for Better Living guides standards for performance, including safety, functionality, and durability, and after-sales service programs for housing components. Certain housing components can be certified as "Quality Housing Components". Those housing components meet the needs of Japanese society regarding energy conservation, elderly support, housing stock utilization, improved security, and other needs. These products are then insured by BL insurance. As of September 2023, 65 items were certified as "Quality Housing Components" (Center for Better Living, 2024)

DBJ Green Building Certification, established in 2011 and conducted by the Japan Real Estate Institute, supports environmentally and socially conscious real estate management through five environmental, social, and governance (ESG)-based evaluations, serving as both an ESG investment index and a dialogue tool for stakeholders, to value sustainable real estate in the market (Development Bank of Japan).

Leadership in Energy & Environmental Design (LEED), developed and operated by the non-profit U.S. Green Building Council (USGBC) and certified by Green Business Certification Inc. (GBCI), is an environmental performance evaluation system for built environments, aimed at transforming global building practices by setting strategies to create high-class, resource-efficient, healthy, and renewable energy-promoting green buildings through a points-based certification method (Green Building Japan, 2024).

WELL certification is a performance evaluation system for built environments that prioritizes human health and well-being. It assesses various features using performance-based metrics, integrating best practices in design, construction, and operation, along with evidence-based medical and scientific research. Initially launched in 2014 and updated to WELL v2 in 2020, the certification evaluates projects across ten core concepts and includes specialized subsets such as WELL Health-Safety Rating, WELL Performance Rating, and WELL Equity Rating. Certification requires compliance with both preconditions and optimizations and mandates periodic recertification every three years (Green Building Japan, 2024).

The eco-symbiosis housing certification, developed by the Institute for Built Environment and Carbon Neutral for SDGs (IBECs), is given to housing and housing complexes that consider energy, resources, waste and other aspects for preserving the global environment, live in harmony with the surrounding natural environment and provide residents healthy and comfortable living arrangements with active involvement in the local area. With this approach living should have a low impact on the environment, be highly interactive, and healthy (IBECs, 2024).

Lastly, **the Japan Housing and Wood Technology Center** certifies building materials that do not use environmentally hazardous materials, improve the indoor environment, or are in other ways environmentally friendly. However, the production and supply system must be in accordance with JCCP's "Technical Standard for Registration of Environmentally Friendly Building Materials". This certification is valid for 3 years, but it is possible to extend the certification (Japan Housing and Wood Technology Center, 2024).

ii. Other important regulations and certifications

Considering that Japan is prone to natural disasters, several other regulations must be considered. For example, for a long period, it was forbidden to construct wooden apartments with three or more stories or with a height of more than 31 meters. Before 1860, wooden constructions were the most common type for housing, public use, temples, shrines, and commercial use. However, brick structures and steel structures with reinforced concrete structures, introduced in the 1860s and the beginning of the 20th century respectively, were promoted for large buildings. Fire codes, including the necessary number of stairs, interior finishing materials, automatic sprinkler systems, etc. were strengthened in 1973 and the 1980s. To prevent conflagrations, covering roofs and exterior walls with noncombustible materials was set as a building requirement. Nowadays, wooden structures have been reconsidered and can be done when countermeasures against fire are considered. As a method to reduce emissions, the government promotes using wooden materials in buildings, which make up 40% of wooden material demand. Therefore, the regulation regarding the use of wooden materials to prevent fire has been eased in 1998 and 2024 for certain structures of buildings. (MLIT, 2024)

Technical requirements provided by the BSL and the Fire Service Law

Fire safety measures	Examples of technical requirements	
	The BSL (Regulates the basic structure and facilities of buildings)	**The Fire Service Law** (Regulates facilities and equipment from a fire safety viewpoint)
Prevention of the spread of fire from adjacent buildings	- Fire-resistance of roofing materials - Fire-resistance of external walls	
Prevention of outbreak of fire	- Fire-resistance of interior finishing materials	- Flame retardant curtains - Restrictions on appliances that operate with a flame
Fire detection		- Fire alarms
Evacuation	- Evacuation facilities, such as escape stairs - Smoke control systems	- Escape facilities, such as escape ladders
Fire extinguishment and rescue	- Emergency elevators - Rescue access	- Fire extinguishing equipment, such as automatic sprinkler systems and standpipe systems
Prevention of spread of fire within a building	- Fire compartments	
Prevention of structural collapse	- Fire-resistance of principal building parts	

Table 4: Technical requirements provided by the BSL and the Fire Service Law (Hasegawa, 2019)

The building code sets out three standards for building materials: non-combustible, quasi-non-combustible, and fire retardant that do not cause combustion phenomena or damage harmful to fire protection, and that have the performance of not generating smoke or gases harmful to evacuation. The performance is specified in the table below according to the length of heating time during which the above performance can be achieved (MILT, 2017).

Categories	Standard	Material examples
Non-combustible *(Funen)*	20 Minutes	Concrete -Brick -Tile Ceramic tiles - Metal sheets Mortar - Rock wool Fiber-impregnated calcium silicate boards 5 mm or thicker Plasterboard at least 12 mm thick
Quasi-non-combustible *(Jun Funen)*	10 Minutes	Wooden cement board at least 15 mm thick Gypsum board of 9 mm or more in thickness
Fire retardant *(Nan-nen)*	5 minutes	Fire-retardant plywood 5.5 mm thick or thicker · Gypsum board of 7 mm or more in thickness

Table 5:Incombustible, semi-incombustible and flame-retardant materials 不燃材料・準不燃材料・難燃材料 (Source: MLIT 2017)

	Target Buildings		Details of Measures	
	Purpose	Scale	Rooms	Aisles
1	Theaters, movie theaters, performance halls, viewing halls, public halls, assembly halls	• Fireproof buildings of 400 m² or more • Quasi-fireproof buildings of 100 m² or more • Other buildings of 100 m² or more	Flame resistant material	Non-combustible material
	Hospitals, clinics, hotels, inns, boarding houses, apartment houses, dormitories, child welfare facilities, etc. (fireproof	• Fireproof buildings of 300 m² or more • Quasi-fireproof buildings of 300 m² or more		

	buildings, etc. zoned 100 m2 are not eligible)	• Other buildings of 200 m² or more		
	Department stores, markets, exhibition halls, cabarets, etc., dance halls, amusement centers, Public bathhouses, waiting rooms, restaurants, eating and drinking establishments, retail stores, etc.	• Fireproof buildings of 1,000 m² or more • Fireproof buildings of 500 m² or more • Other buildings of 200 m² or more		
2	Automobile garage/repair shop, basement of use in ①	-	Non-combustible material	Non-combustible material
3	For all purposes	• 3 or more floors with a total floor area of over 500 m² • 2 floors with a total floor area of over 1,000 m² • 1 floor with a total floor area of over 3,000 m²	Flame resistant material	Non-combustible material
4	No-window room on interior restrictions	-	Non-combustible material	Non-combustible material
5	Fire room (Residential)	Excluding the top floor (2 or more floors)	Non-combustible material	-
	Fire rooms (other than residences)	-	Non-combustible material	-

Table 6: Restrictions on interior materials 内装材料の制限 (Source: MLIT 2017)

Regarding building codes for earthquake activity, the first seismic code was adopted in the year following the 1923 Great Kanto earthquake, but it was considered insufficient as some earthquakes such as the Niigata earthquake in Japan in 1964, showed that the seismic codes at that time were not sufficient to maintain safety against earthquakes. The Great Hanshin-Awaji earthquake in 1995 necessitated further improvements to the seismic code. The Act on Promotion of seismic Retrofit of Building was enacted for existing buildings in 1995. (Okada, 2021)Since this act has been conducted, big-scale buildings such as hospitals, schools, shopping centers, and nursing homes are required to take seismic force tests and make the results public. (MLIT)

Tsunami evacuation buildings must provide a necessary evacuation height, easy access, and power supplies, disaster prevention warehouses, and ambulance sites. And this should be made by either reinforced concrete or steel frame reinforced concrete (MEXT). Guidelines for Evacuation Buildings are provided by the Ministry of Land, Infrastructure, Transport and Tourism. The National Institute for Land and Infrastructure Management (NLIM) and Japan's Building Research Institute (BRI) continuously develop more in-depth recommendations for designs of tsunami evacuation structures. However, verification of structural safety against tsunami loading is not prescribed in the Building Standard Law of Japan according to the EEFIT (2013) and Hitomitsu (2011) (Macabuag et al., 2018). Exceptions are buildings within local government-designated 'high-risk areas' under BSLJ article 39 (Macabuag et al., 2018). Buildings in the specific area might face the danger of natural disasters such as landslides by heavy rainfall or heavy snowfall must be equipped.

Generally, housing structures must be secured enough against permanent load, imposed load, snow load, wind pressure, seismic force, and others. Structural specifications are provided for diverse types of structures. Wooden structures for example have regulations for the structure of sill and foundations, size of posts, necessary strength and quantity of braces and structural frames, methods of using joints or connection, and quality of preservative measures. Regulations for masonry structures, reinforced concrete block structures, steel structures, reinforced concrete structures, steel, and reinforced concrete composite structures, plain concrete structures, and other structural types like wood-frame structures, pre-stressed concrete structures, and box-frame type reinforced concrete structures exist as well. The seismic codes, which were revised in 1981, provide a two-phase seismic design for medium-scale and large-scale earthquakes (Hasegawa, 2019).

Building Materials are evaluated by the Building Center of Japan. In total, 19 different building materials are evaluated regarding their performance. These include seismic isolation devices, concrete and concrete blocks, high-strength bolts and bolts, steel bars and wood-based glued axial materials (The Building Center, 2024).

Since the 1980s the Sick Building Issue has become a major concern. Buildings must have an adequate sanitary system. According to the Building Standard Law in 2003, it is forbidden to use asbestos in building materials as well as sprayed asbestos and building materials in habitable rooms that potentially emit chlorpyrifos. Building materials that might emit formaldehyde are restricted in use, as well. In addition, in the case of a house, it is necessary to install mechanical ventilation equipment according to the revised building standards law in 2003. (MLIT, 2022) In 2003, JIS (Japanese Industrial Standard) and JAS (Japanese Agricultural Standard) made it mandatory to grade F-stars according to formaldehyde emission rate, thereby setting restrictions on the area of use (Okajima Mokuzai Kogyo, 2022).

JIS・JAS Indications	Material Category	Dissipation Rate Criteria	Restrictions of use area
F☆☆☆☆	Not subject to regulation under the Building Code	0.005 mg/m2h or less	No restrictions
F☆☆☆	Class 3 formaldehyde-emitting building materials	More than 0.005 mg/m2h and less than or equal to 0.02 mg/m2h (in summer)	Restricted. (quantity varies according to ventilation volume)
F☆☆	Class 2 formaldehyde-emitting building materials	0.02 mg/m2h or more and 0.12 mg/m2h or less (in summer)	Restricted. (quantity varies according to ventilation volume)
No indication	Class 1 formaldehyde-emitting building materials	0.12 mg/m2h or more (in summer)	Forbidden to use

Table 7: Standard for F4 stars (Source: Okajima Mokuzai Kogyo)

The "Study Group for Standardization of VOC Emission Rates from Building Materials (Secretariat: Japan Testing Centre for Construction Materials)" established the "VOC Emission Rate Standards from Building Materials" on 1 April 2008 (Japan Construction Material & Housing Equipment Industries Federation, 2019).

	Guideline value*.	Dissipation rate reference value
toluene	260 μg/m_3	38 μg/(m_2・h)
Xylene	200 μg/m_3	29μg/(m_2・h)
ethyl benzene	3800 μg/m_3	550 μg/ (m_2・h)

Styrene	220 μg/m_3	32 μg/ (m_2・h)

* Ministry of Health, Labor, and Welfare indoor concentration guideline values.

Table 8: VOC Emission Rate Standards from Building Materials on 1 April 2008 (Japan Construction Material & Housing Equipment Industries Federation, 2019)

iii. Taxation system: Tariffs & Taxes

The Housing Tax System in Japan encompasses a range of taxes, including acquisition, maintenance, retrofitting, and ownership. Currently, stamp duty, registration and license tax, real estate acquisition tax, and consumption tax are applied to housing. Stamp duty, registration, and license tax are national taxes. Real estate acquisition tax is a local tax. The consumption tax can be either national or regional. For maintenance, fixed-property tax, and urban planning tax, both as local taxes, are applied. Fixed-property tax can be reduced for newly built housing under certain circumstances. Furthermore, specific measures have been established to improve the residential living standards by encouraging housing acquisition and forming a quality housing stock. Tax relief for housing loans, registration and licensing tax reductions, and real estate acquisition tax reductions are relevant for acquiring environmentally friendly properties. In addition, special measures relating to retrofitting work are helpful to make housing better: tax measures to facilitate seismic retrofitting of existing housing, tax measures to facilitate barrier-free retrofitting of existing housing, tax measures to facilitate energy efficiency retrofitting, tax measures to facilitate retrofitting for living together and tax system to promote improvement for long-life quality housing (Center for Better Living, 2024).

The Government of Japan promotes eco-housing by providing subsidies. The “Residential Energy Conservation 2024 Campaign” is following four subsidized projects by MLIT, METI, and MoE that support residential energy conservation, such as the improvement of home insulation and the introduction of high-efficiency water heaters, to strongly promote energy conservation in the residential sector toward the achievement of carbon neutrality in 2050 (METI).

- Eco-friendly Home for households raising children.
    - Certain insulation improvements to openings or frames, and installation of eco-friendly housing equipment (e.g., hot water-saving taps, high-insulation bathtubs.)
    - Childcare-responsive renovation, barrier-free renovation, installation of air-cleaning, ventilation, air-conditioning with air-cleaning and ventilation functions
    - Households with children and young couples:
      Maximum of JPY 300,000/unit
      Other households: Maximum of JPY 200,000/unit
    - In the case of long-term excellent renovation
      Households with children and young couples: Maximum of ¥450,000/unit
      Other households: Maximum ¥300,000/unit
      Households raising children and young married couples with the purchase of an existing house: up to ¥600,000/unit

- Advanced Window Renovation
  High-performance heat-insulating windows
  UW value (thermal transmittance) 1.9 or less
  Subsidy Amount: Max. ¥2 million /housing unit

- Hot water supply energy saving

High-efficiency water heaters
Subsidy Amount:
(a) Heat pump water heaters: ¥100,000
(b) hybrid water heaters: ¥130,000
(c) household fuel cells: ¥200,000

- Hot Water Supply Energy Saving for Rental Apartments
  "ECO Jozu" (Energy-efficient water heaters that efficiently boil water using less gas), "ECOFIELE" (petroleum water heater that recovers and reuses exhaust heat that would otherwise be discarded)

  Subsidy Amount:
  Without additional firing function: ¥50,000
  With additional firing function: ¥70,000

The Japanese government has started an eco-housing campaign which provides grants for a renovation that uses subsidized products. For energy efficiency, these four are the main ways of renovation, using energy creation & utilization of renewable energy, reducing energy consumption, solar shading, and improving thermal insulation performance (see Chapter 5 b.) The grant budget of the government campaign for this is 135.0 billion yen and 142,303 houses have already installed eco-efficient windows or doors which evaluates 32% of the grant budget as of 10.09.2024 (Eco-Home Support Project Secretariat).

6. Technology trends and Potentials

a. Insulation Materials

The most common method of timber house construction is 2x4 construction with filled insulation as internal insulation (see fig. 8). External Wall Insulation Systems (EWIS) and External Thermal Insulation Composite System (ETICS) for residential applications have seen significant growth in recent years but are still not as common as in many European countries. In fact, 87% of the stock out of approximately 50 million housing stock in Japan, excluding empty house does not meet the energy efficiency grade 7 for external envelope performance(MLIT,2022). Facades are often covered with fibre cement panels.

2x4 construction method with internal insulation

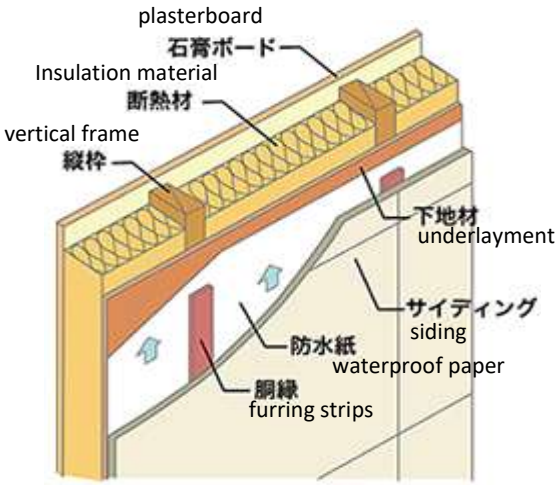


Figure 8: 2x4 construction method (Source: Japan 2x4 home builders association Tohoku)

Expanded polystyrene (EPS) and Glass wool or mineral wool are commonly used for insulation materials. According to the Yano Research Institute, Glass Wool and Rock Wool account for over 50% of the total insulation material in Japan. Rigid polyurethane foam accounts for approx. 20% (Nikkei Shimbun, 2021).

Reference values of insulation thicknesses for walls are set differently depending on the region (regions 1 to 8) so that buildings can meet the energy-saving standards of the Ministry of Land and Transport and the Ministry of Economy, Trade, and Industry. The whole country is divided into eight regions, and the standard values for the UA and ηAC value grades are defined for each region.

Average heat transfer coefficient at the external envelope (UA code) by category [Unit W/(M2・K)]

	Area Category							
	1	2	3	4	5	6*	7	8
Grade 7	0.20	0.20	0.20	0.23	0.26	0.26	0.26	-
Grade 6	0.28	0.28	0.28	0.34	0.46	0.46	0.46	-

Grade 5	0.40	0.40	0.50	0.60	0.60	0.60	0.60	-
Grade 4	0.46	0.46	0.56	0.75	0.87	0.87	0.87	-
Grade 3	0.54	0.54	1.04	1.25	1.54	1.54	1.81	-
Grade 2	0.72	0.72	1.21	1.47	1.67	1.67	2.35	-
Grade1	-	-	-	-	-	-	-	-

Guidance standard

Energy-saving standard

*e.g.Osaka,Tokyo

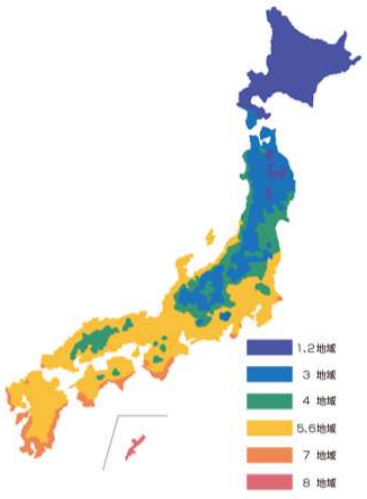
※Smaller UA code means a higher energy-saving standard.

Average solar radiation acquisition rate (ηAC code) during the cooling season by category

	Area Category			
	5	6*	7	8
Grade 7	3.0	2.8	2.7	-
Grade 6	3.0	2.8	2.7	5.1
Grade 5	3.0	2.8	2.7	6.7
Grade 4	3.0	2.8	2.7	6.7
Grade 3	4.0	3.8	4.0	-
Grade 2	-	-	-	-
Grade 1	-	-	-	-

Guidance standard

Energy-saving standard



*e.g.Osaka,Tokyo

※Smaller ηAC code means a higher energy-saving standard.

Table 9: UA code and ηAC code by regions (Source: MLIT)

Glass wool is Japan's most used insulation material for residential buildings due to its cost performance. However, innovative insulation materials have been getting more attention to realize eco-housing. **Japan Insulation Co., Ltd**. has created an innovative technology that uses biomass, specifically rice husks, as a raw material to produce thermal insulation materials. While primarily developed for industrial applications, this eco-friendly insulation technology could be adapted for residential use, and it offers non-combustible properties, lightweight construction, and environmental sustainability.

Thermalytica, a spin-off company of the National Institution for Material and Science in Ibaragi Prefecture, developed TIISA (Thermal Insulation Inflatable Solid Air), which has high thermal insulation and fire resistance. With a particle

size of just 300nm, TIISA® is made up of ultra-small particles, 1/1000th the size of traditional powder-form aerogel (Thermalytica). It is expected to be used as roof insulation and insulation paint (Tsukuba City).

As a result of joint research with Kyoto University, **Tiem factory** has succeeded in developing aerogels that do not require supercritical drying equipment. Aerogels could only be made using supercritical drying equipment, which led to extremely high production cost.

SUFA (Super Functional Air) can be produced at ambient pressure, therefore it is not affected by the size of the drying equipment and large monoliths (transparent platelets) can be envisaged. In addition, SUFA has a soft and fine skeleton and is strongly water-repellent, making it easier to handle, more transparent, and less susceptible to degradation than conventional aerogels. If SUFA monoliths are successfully mass-produced, Tiem Factory will be the world's first supplier of transparent insulation materials.

High thermal insulation technologies of aerogels have been used for the window by **TAKENAKA CORPORATION.** Their aerogel glass panel is characterized by its performance over the long term because this constant air pressure inside the glass prevents the gel layer from settling due to the bulge of the translucent plate. According to their experimentation, energy usage of the office zone with this panel is 10% to 20% less than without a panel.

b. Windows

According to the data of the Ministry of Environment, 60.7% of houses constructed after 2021 have double sash or double-glazed windows installed on all windows.

Double sash or double-glazed windows by date of construction

[Households] [%]

	Distribution of households (adjusted for extraction rate)	Total number of households	Installed on all windows	Partially installed	None	Unknown
Before 1970	7,329	717	8.2	15.4	75.6	0.8
1971～1980	11,327	1,059	15.1	17.2	66.7	1.0
1981～1990	16,964	1,603	16.1	17.0	64.4	2.6
1991～2000	22,414	2,077	19.6	14.7	61.9	3.9
2001～2005	10,602	960	34.1	18.4	43.4	4.1
2006～2010	9,569	921	44.5	14.1	38.3	3.1
2011～2015	6,400	680	52.7	15.4	23.0	9.0
2016～2020	6,165	656	58.6	11.5	19.7	10.2
After 2021	974	107	60.7	10.6	18.0	10.8
Total	100,000	9,479	25.7	14.8	54.9	4.5

Table 10: 2022 Statistical Survey on CO_2 Emissions from the Household Sector (Source: Ministry of Environment, 2024)

In Japanese housing, aluminum sash is used for window frames in most cases. In 2022, 75% of sashes in detached house in Japan were made of aluminum, and only 25.9% of resin (Japan sash Association, 2022). Aluminum is resistant to corrosion, rust, and weathering, making it ideal for Japan's varied climate conditions. It requires minimal upkeep compared to traditional wood frames. Aluminum sashes are generally more affordable than other materials, making them an attractive option for both residential and commercial construction. However, they are not always the most

energy-efficient option. Recent trends in Japan are moving towards more insulated options, including multi-layered glass and improved frame designs, to enhance thermal performance. **YKK AP** has promoted upgrading to insulated windows with their various types of resin internal windows, MADORIMO, which can be attached to existing windows. Since resin windows are high insulation, this makes the house energy consumption and air-conditioning expenses low. Furthermore, this well-insulated internal window could be adapted for residential use with about 60 minutes of reform for a window.

c. Smart Housing, HEMS, BEMS

Panasonic launched a project in the city of Fujisawa called Fujisawa SST. All detached houses in Fujisawa SST's detached blocks (approximately 600 lots) are equipped with solar power generation systems and storage batteries and are CO_2±0 smart houses.CO_2 ± 0 means that the amount of CO_2 emitted through energy use in the home and the amount of CO_2 reduced through energy creation can be reduced to a total of ± 0 per year. This makes a significant contribution to the city's overall CO_2 reduction target. To meet the energy needs of different lifestyles, Fujisawa SST offers an all-electric type with solar power and a dual power generation type with solar power and fuel cells (ENE-FARM). The electrical equipment required in an emergency (e.g., communication equipment for displaying information, a refrigerator for storing food, living room lighting for peace of mind) is set to be supplied from solar power and storage batteries. In the event of a disaster or other emergency, the system automatically switches to the pre-set circuit and is self-sufficient in the minimum required energy, ensuring a lifeline for three days.

Smart Heim Navi, a service provided by **Sekisui Heim**, visualizes energy self-sufficiency rates, provides oversight of equipment such as solar power generation, storage batteries, and HEMS. Smart HEIM FAN is a membership website that provides energy-saving information for people living in HEIMs. It uses data from approximately 60,000 houses to analyze electricity and works in conjunction with Smart HEIM Navi (Sekisui Heim).

d. Cement, Wood, Steel Construction Materials

In 2018, 56% of residential buildings in Japan were made from wood, while 43.3% of non-wooden houses were made from steel frames and concrete (see Chapter 5.b.). Non-wood refers to buildings that use steel frames and concrete as building materials. The use of timber in buildings is expected to contribute to the prevention of global warming, such as realizing carbon neutrality by 2050. However, in urban areas, fire-resistant performance is required for buildings. "Moen Wood" of Takenaka Corporation is a technology certified by the Ministry of Land, Infrastructure and Transport as fire-resistant construction. The three-hour fire-resistant Moen wood enables the use of wooden structures in buildings with no restrictions on the number of floors, making it possible to convert buildings with more than 15 floors into wooden structures.

Taiheiyo Cement produces Ecocement made from incineration ash, sludge, and other waste materials. In July 2002, it was certified by the Japanese Industrial Standards (JIS R 5214). Ecocement maintains nearly the same quality as ordinary Portland cement and can be widely used in everything from concrete products to reinforced concrete structures (Taiheiyo Cement). The Ecocement received the Environment Minister's Award in 2001, Nikkei Excellent Products and Services in 2001, and the Global 100 Eco Tech Award in 2005. Dioxins in the incinerator ash are safely decomposed as the ash is treated at temperatures above 1350°C. Heavy metals in the incineration residue are recovered and recycled, and no new waste is generated. Compared with other municipal solid waste incineration residue disposal methods and conventional landfill disposal, not only are CO_2 emissions and waste generation reduced, but also the consumption of natural raw materials such as limestone, clay and silica stone can be reduced. The recovery and recycling of heavy metals also contribute to the conservation of metal resources (Taiyo Cement).

e. Paints and Plasters

Dry construction is a major method of interior decoration in Japan in particular, and vinyl cloth is mostly used to keep prices down. However, paints made from natural materials are spreading, especially among customers with high awareness of ecological and high-quality products, to improve the living environment, and due to the increased awareness of health issues. Many ecological paints come from Europe, especially Germany such as Livos, Osmo, and Auro. Japanese natural materials, such as diatomaceous earth (*called Keisoudo*) and Japanese plaster (*called Shikkui*), also attract attention again for both exterior and interior use.

Regarding exterior material, mortar was the most used material in Japan. However, in recent years, siding boards have become increasingly popular because of their low price and ease of installation compared to mortar. In addition, plaster (Shikkui in Japanese), with its high durability and humidity control properties, is a traditional material that has been used in the interior and exterior of buildings in Japan.

Aimori INC., located in Hokkaido, produces the Japanese Plaster made from scallop shells. Hokkaido is a popular place for scallop farming and more than 200,000 tons of shells are discharged every year and most of these were discarded and piled up in the past. In cooperation with Helmut Reichel Putz und Farbenges.mbH in Germany, they provide high-quality plasters with scallop shells for exterior and interior use.

f. HVAC

Japan's heating and cooling systems in buildings are highly advanced, emphasizing energy efficiency and sustainability. Inverter air conditioners, which provide both heating and cooling, dominate the residential market along with the statistic that more than 90% of Japanese household have these (Ministry of Environment). Heat pump technology is increasingly important for carbon neutrality, but in colder northern regions, combustion heating is still common due to higher heating demands. The volume of heat pump water heaters shipped was approximately 700,000 units and JRAIA (the Japan Refrigeration and Air conditioning industry Association) aim to introduce 15.9 million units in total by the end of FY2030 to achieve carbon neutral in 2050. (JRAIA, 2023)

LIXIL Corporation (LIXIL) will launch the EcoAir Fine whole-house air conditioning system, which keeps the entire house at a comfortable room temperature and clean air 24 hours a day, 365 days a year, in summer and winter, nationwide (excluding Hokkaido, Okinawa, and isolated islands) from 1 June 2023 (Nikkei Shimbun, 2023)

The Heat Exchange Ventilation System of Panasonic suppresses power consumption by reducing the exhaust air flow rate, while keeping the same supply air flow rate. When the air temperature outdoors is lower than those of indoors and there is an increase in natural ventilation because of draughts and the like in winter, the ventilation system suppresses the power consumption by reducing the amount of ventilation (both the air supply and the exhaust). The ventilation system efficiently controls switching between the two DC motors for the air supply and exhaust with a constant airflow control function, heat exchange ventilation, and normal ventilation, using temperature sensors and humidity sensors. Accordingly, the optimal airflow and the ventilation method realize both comfort and energy-saving.

7. Implications for European SME Companies

a. Potential

The future of eco-housing in Japan appears promising, with significant potential for growth and innovation. Here is an overview of the potential and future perspective.

- Necessity of Insulation: Japanese houses have historically been poorly insulated. Until the revision of the Building Efficiency Code, insulation guidelines had not been updated for a long time. As a result, many Japanese homes suffer from poor temperature regulation, high energy costs, and discomfort during extreme weather. Therefore, there is a huge potential for innovative and efficient insulation material. Exterior insulation in Japan has not yet been widely adopted compared to Europe.
- Government Support: As mentioned in Chapter 4, the Japanese government has set ambitious goals for sustainable housing. They approved an energy policy to make Zero Net Energy Houses (ZEH) the standard for new house construction by 2030. This strong governmental support promotes the adoption of eco-friendly housing solutions.
- Growing Awareness of energy efficiency: There is a growing trend towards sustainable and eco-friendly housing designs in Japan. This includes renewable energy sources, energy-efficient technologies, and innovative architectural solutions. Technological Innovation: Japan is well-known for its technological advancements, and this expertise is being applied to eco-housing. Companies are developing innovative solutions such as energy-efficient LED lighting, improved heat insulation, and advanced air conditioning systems. Especially for European companies that have complementary technologies to contribute to energy efficiency, there is potential in the Japanese market.

b. Challenges

There are specific challenges and regulatory issues foreign companies are facing when entering the Japanese eco-housing market:

- Japan is known for its technological advancements and innovation. That means some eco-housing products may already exist in Japan. Furthermore, in the distribution channel, many companies have well-established networks, references, and customer relationships. There needs to be strong USPs and cost competitiveness if foreign companies want to enter the market and the network. The decision-making in Japan takes exceptionally long. It is recommended to take more than one year to establish relationships in Japan.
- Although the Japanese normally seek good qualities, cost performance is one of the key factors for end consumers in the housing sector. Many consumers tend to use conventional products to keep costs low, even if they know they are not sustainable for the long term. It is a severe challenge for European companies to realize both high quality and cost competitiveness.
- Relevant certifications in Japan are time-consuming and may set different parameters from European standards. It is essential to have good partners helping with these procedures in the Japanese language.
- While there's growing interest in eco-housing, there are still challenges to overcome. A study found that Japanese respondents generally lack an understanding of renewables, and the level of interest in installing solar PV and willingness to pay for ZEH is relatively low. This suggests a need for increased education and awareness campaigns in the country (Sustainability Science, 2024).

- The high initial costs of eco-housing technologies remain a barrier to widespread adoption. Future policies may need to address this through expanded subsidies or other financial incentives.
- Regarding tendering for public projects, it is difficult for a foreign company to win a contract. Obstacles include the lack of transparency in the tendering process, specific conditions that are difficult for foreign companies to meet, vague evaluation criteria, difficulty to access to relevant information, and the requirement for prior domestic project references. The best strategy for a European company is to collaborate with a Japanese company, become acquainted with the tendering process, and collect domestic references.

c. Recommendations

For the eco-housing field, it is recommended for European companies to:

- **Focus on energy efficiency**: Housing Is responsible for about 30% of CO_2 emissions in Japan. Therefore, there is a significant opportunity to introduce energy-efficient solutions. European companies should emphasize technologies and designs that reduce electricity consumption and improve insulation
- **Highlight innovative technologies**: Japanese consumers are often receptive to advanced technologies. European companies should showcase their innovative eco-friendly solutions, particularly those related to smart home systems, energy management, and sustainable materials such as insulation systems.
- **Emphasize long-term benefits**: While Japanese houses are traditionally built with a shorter lifespan, there is growing interest in more sustainable, long-lasting homes. European companies can highlight the durability and long-term cost savings of their eco-housing solutions. It is recommended to explain this point with concrete calculations.
- **Utilize support services**: Take advantage of organizations which offer market entry consulting, research, and networking opportunities specifically for European companies entering the Japanese market.
- **Understand local climate challenges**: Develop eco-housing solutions that address Japan's specific climate conditions, including high humidity and natural disaster resilience. It is essential to show proof that products can fit the climate conditions in Japan.

When European technology providers enter the Japanese market, they must tailor their approach to the specific needs and requirements of the Japanese market. To be successful in the Japanese market, European companies should pay close attention to the following general factors:

- **Time and human resources are required**: Entering the Japanese market requires significant financial, time, and human resource investments. A thoughtful long-term approach is necessary to achieve success and make a positive impact in this demanding market.
- **Select reliable partners**: Carefully select reliable partners to work with, as they can have a significant impact on the success of market entry.
- **Interpreters:** Never skimp on a highly qualified interpreter, as this person represents the company and needs to understand and convey more than just words. It is recommended to use the same interpreters for the whole project.
- **Realize reference projects in Japan**: Japan's climate differs from that of Europe in that it is humid and varies greatly from region to region. Therefore, in many cases, presenting successful examples and reference projects in Europe is not convincing enough. Therefore, launching a demonstration project in Japan at an early stage is essential for market entry and gaining the trust of partners/customers.

- Build strong **customer relationships**: Focus on building and maintaining excellent customer relationships. Regular visits, including courtesy visits, are essential to build trust and visibility.
- Build **local networks**: Work on building local networks and personal relationships as these play a vital role in business development and success.
- Attending important **trade fairs**: Participating in prominent trade shows is essential for gaining exposure and networking.
- **Detail and image**: Japanese consumers value attention to detail, so invest in areas such as professional interpretation services and PR material to ensure clear communication and a positive image. Seeing is believing. When creating PR materials, videos that show the construction process are also beneficial.
- **Highlight EU origin**: Capitalize on the excellent reputation of European environmental technologies and proudly display EU origin, especially for companies from Germany, which is known for ecological products.

8. References

Building Research Institute (2024): LCCM (Life Cycle Carbon Minus) Houses as advanced energy-efficient housing for a low-carbon society, https://www.kenken.go.jp/english/contents/lccm/index.html, Accessed 26.08.2024

CASBEE (2024): Basic Concept of CASBEE, https://www.ibecs.or.jp/CASBEE/english/basicconceptE.htm, Accessed 26.08.2024

CASBEE (2024): Built Environment Efficiency (BEE), https://www.ibecs.or.jp/CASBEE/english/beeE.htm Accessed 26.08.2024

CBRE (2024): 2023 Japan Green Building Certification Trends, https://mktgdocs.cbre.com/2299/8fcf8bf4-fe1b-4e66-812d-23862cdd8ec5-794098262/Japan_20Special_20Report_20Gre.pdf Accessed 26.08.2024

Center for Environment and Energy Conservation (2022): Types of ZEH, Experts on ZEH thoroughly explain their features and differences [2022 edition], https://www.ceec.jp/column/zeh-kind/#ZEH%E3%83%BBZEH, 09.06.2022

Development Bank of Japan: DBJ Green Building Certification, https://www.dbj.jp/en/service/program/g_building/?sc=1 Accessed 26.08.2024

EU-Japan Centre (2023) : Eco Construction, https://www.eu-japan.eu/eubusinessinjapan/sectors/construction/eco-construction, April 2023

Forestry Agency (2023): Act on the Promotion of the Use of Wood in Buildings to Contribute to the Realization of a Decarbonized Society, https://www.rinya.maff.go.jp/j/riyou/kidukai/mokuri_kyoutei/attach/pdf/index-2.pdf, July 2023

Green Building Japan (2024): What is LEED?, https://www.gbj.or.jp/well/about_well/?_x_tr_sl=ja, Accessed 26.08.2024

Green Building Japan (2024): What is WELL?, https://www.gbj.or.jp/well/about_well/?_x_tr_sl=ja, Accessed 26.08.2024

Japan Construction Material & Housing Equipment Industries Federation (2019): Basic matters relating to the operation of the labelling system for VOC emission rate standards from building materials, https://jfpma.jp/docs/4voc/4voc_kihon.pdf, 28.06.2019

Japan Metrological Agency (2024): General Information on the Climate of Japan, https://www.data.jma.go.jp/cpd/longfcst/en/tourist.html, accessed 26.08.2024

Japan Sash Association (2022): Overview of Survey on the Use of Building Materials for Residential Use, https://www.jsma.or.jp/Portals/0/images/statistics/pdf/chousagaiyou2203.pdf, 02.05.2022

Japan 2x4 Home Builders Association Tohoku: What is a 2x4 home?, http://www.tohoku.2x4assoc.or.jp/about/index.html, accessed 03.09.2024

Macabuag, Raby, Pomonis et al. (2018): Tsunami design procedures for engineered buildings: a critical review. Proceedings of the Institution of Civil Engineers – Civil Engineering, https://doi.org/10.1680/jcien.17.00043,11.04.2018

Ministry of Education, Culture, Sports, Science and Technology, JAPAN: Guidelines for Tsunami Evacuation Buildings, etc.,https://www.mext.go.jp/b_menu/shingi/chousa/shisetu/013/007/shiryo/__icsFiles/afieldfile/2013/08/19/1338212_3.pdf#:~:text=%E3%81%93%E3%81%86%E3%81%97%E3%81%9F%E7%8F%BE%E7%8A%B6, Accessed 19.09.2024

Ministry of Environment (2024): 2022 Statistical Survey on CO_2 Emissions from the Household Sector, https://www.env.go.jp/content/000212356.pdf, 03.2024

Ministry of Land, Infrastructure, Transport and Tourism, JAPAN (2017): Building code system overview book, https://www.mlit.go.jp/common/001215161.pdf,20.12.2017

Ministry of Land, Infrastructure, Transport and Tourism, JAPAN (2024): Building Reform and Renewal Survey Report, https://www.mlit.go.jp/report/press/content/001762274.pdf, 10.09.2024

Ministry of Land, Infrastructure, Transport and Tourism, JAPAN (2023): Data related to housing and economy, 2023, https://www.mlit.go.jp/statistics/details/t-jutaku-2_tk_000002.html, Accessed 26.08.2024

Ministry of Land, Infrastructure, Transport and Tourism, JAPAN (2023): 2023 Energy-saving promotion project for existing buildings, https://www.mlit.go.jp/jutakukentiku/house/shienjigyo_r5-18.html, 05.06.2023

Ministry of Land, Infrastructure, Transport and Tourism, JAPAN (2022): Examples of Initiatives for Promoting Efficient Ventilation in Buildings, https://www.mlit.go.jp/jutakukentiku/build/content/001487964.pdf,

Ministry of Land, Infrastructure, Transport and Tourism, JAPAN: Establishment of higher grades for energy-saving performance in the Housing Performance Indication System, https://www.mlit.go.jp/jutakukentiku/house/content/001424534.pdf Accessed 26.08.2024

Ministry of Land, Infrastructure, Transport and Tourism, JAPAN: Future energy-saving measures for housing and buildings (Third Report) and the building standards system (fourth report), https://www.mlit.go.jp/policy/shingikai/content/001460570.pdf, 20.01.2022

Ministry of Land, Infrastructure, Transport and Tourism, JAPAN (2023): Japan's Policy toward Carbon Neutrality in the Housing and Building Sectors, https://www.aivc.org/system/files/01-01-04%20Takashi%20Imamura%20AIVC.pdf, 18.05.2023

Ministry of Land, Infrastructure, Transport and Tourism, JAPAN (2023): Overview of new law of energy consumption performance of buildings, https://www.mlit.go.jp/jutakukentiku/house/shouenehou_r4.html, 15.12.2023

Ministry of Land, Infrastructure, Transport and Tourism, JAPAN (2016): Overview of the Act on the Improvement of Energy Consumption Performance of Buildings, https://www.mlit.go.jp/common/001134876.pdf, April 2016

Ministry of Land, Infrastructure, Transport and Tourism, JAPAN (2019): Overview of the Act on Promotion of Seismic Retrofitting of Buildings, https://www.mlit.go.jp/jutakukentiku/build/content/001466564.pdf, 1.1.2019

Ministry of Land, Infrastructure, Transport and Tourism, JAPAN: Strengthening support for energy-saving renovation of homes, https://www.meti.go.jp/press/2023/12/20231226002/20231226002-rrr1.pdf, Accessed 26.08.2024

Ministry of Land, Infrastructure, Transport and Tourism, JAPAN (2022): Summary of the White Paper on Land, Infrastructure, Transport and Tourism in Japan, 2022, https://www.mlit.go.jp/en/statistics/content/001579732.pdf, Accessed 26.08.2024

Nikkei Shinbun (2023): LIXIL launches Eco-Air Fine whole-house air conditioning system, https://www.nikkei.com/article/DGXZRSP655848_V20C23A5000000/,25.05.2023

Nikkei Shinbun: Yano Research Institute Releases Survey results on Domestic Home Renovation Market, https://www.nikkei.com/article/DGXZRSP677737_T00C24A9000000/?msockid=301bc2dcb32a68122d93d63eb2ea698f, 03.09.2024

Nomura Research Institute (2021): Nomura Research Institute forecasts the housing market for 2040, https://www.nri.com/jp/news/newsrelease/lst/2021/cc/0608_1,08.06.2021

Okajima Mokuzai Kogyo (2022): What are the F☆☆☆☆ (FFORSTAR) standards? An explanation of the translations required to create safe and comfortable spaces, https://www.okajimawood.co.jp/column/202202_03-2/, 09.11.2023

Sekisui Heim: How HEMS (Smart Heim Navi) works, https://www.sekisuiheim-owner.jp/reform/lifeline/hems/, Accessed 26.08.2024

Springer Nature (2024): Public perceptions on net zero energy houses in Japan, https://link.springer.com/article/10.1007/s11625-024-01501-w,15.05.2024

Taiyo cement: Feature of eco-cement, https://www.taiheiyo-cement.co.jp/service_product/recycle_mw/eco/points.html,Accessed 26.08.2024

Takenaka Corporation (2022): Development and application of aerogel glass panels with both translucency and thermal insulation properties, https://www.takenaka.co.jp/news/2022/04/04/index.html, 25.04.2022

Takenaka Corporation: Wide-range Applications of the Fire-resistant Laminated Material Moen-Wood, https://www.takenaka.co.jp/takenaka_e/solution/environment/moenwood/, Accessed 26.08.2024

T. Akimoto (2017), Shibaura Institute of Technology Department of Architecture: https://www.internationalhousingassociation.org/fileUpload_details.aspx?contentTypeID=3&contentID=259600&subContentID=706328&channelID=38488, 10.11.2017

T.Okada(2021), Development and present status of seismic evaluation and seismic retrofit of existing reinforced concrete buildings in Japan, https://www.jstage.jst.go.jp/article/pjab/97/7/97_PJA9707B-03/_pdf/-char/en, 07.07.2021

T.Tanaka (2018), External Thermal Insulation Composite System (ETICS) in Japan, https://www.jstage.jst.go.jp/article/shasetaikai/2018.5/0/2018.5_97/_pdf/-char/ja, 2018

T. Hasegawa (2019): Building Control in Japan, https://www.iibh.org/kijun/pdf/BCinJ_Part_D_1910.pdf, Accessed 26.08.2024

The Association for Evaluating and Labeling Housing Performance (2002), https://www.hyoukakyoukai.or.jp/bels/info.html, Accessed 26.08.2024

The Building Center of Japan (2022): A QUICK LOOK AT HOUSING IN JAPAN 2023-2024, https://www.cbl.or.jp/slc/file/english.pdf, Accessed 26.08.2024

The Building Center of Japan (2024): Building Materials, https://www.bcj.or.jp/en/services/evaluation/materials/, Accessed 26.08.2024

The Japan Real Estate Institute: About issuing "Housing Energy Saving Performance Certificate", https://www.j-eri.co.jp/download/erihp/90_gyo/gyo31_hakkogyomu.pdf?ver=2405, 04.2024

The Japan Refrigeration and Air Conditioning Industry Association (2023): The Act for Carbon neutral in 2050 https://www.meti.go.jp/shingikai/enecho/shoene_shinene/sho_energy/pdf/041_05_00.pdf, 24.05.2023

tiem factory Inc.: About SUFA, https://www.tiem.jp/aboutsufa, Accessed 26.08.2024

Tsukuba City: 'Using super-insulation material TIISA® to Building a decarbonised society' demonstration, https://www.city.tsukuba.lg.jp/material/files/group/18/summary_report_thermalytica.pdf, Accessed 26.08.2024

Yano Research Institute (2023): Study conducted on the residential insulation building materials market (2023), https://www.yano.co.jp/press-release/show/press_id/3450, 18.01.2024

YKK AP: YKK eligible products for the Advanced Window Renovation Project,

https://www.ykkap.co.jp/consumer_business/satellite/law/subsidy2024/senshintekimado/item/, Accessed

29.08.2024

Published by the EU-Japan Centre for Industrial Cooperation – Office in the EU (Director: Diane Van Bockstal). Rue Marie de Bourgogne, 52/2 B-1000 Brussels, Belgium.