Sustainability, embodied in the local context: A study on the cultural aspects of environmentally symbiotic housing in Japan

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1. PREFACE

Post-war housing policies had always been one of major drive of improving social welfare and the economic growth of Japan through building industry. I belong to the baby-boomer generation, observing and enjoying the tremendous change and development during the last five decades. For us, one of the most impressive cultural transitions of built environment has been experienced in the housing. Although our ancestor created most sensitive and environmentally responsive housing culture of wood, earth and paper, general attitude of post-war Japanese put it lower value, in comparison with occidental image of houses, which seemed to us much more advanced “culturally”.

This attitude was based somehow on a sense of shame deriving from the materialization gap between the winners and the loser. To catch up this materialized level, therefore, became the clearest and simplest goal as political and social propaganda. But this catching-up efforts have been more or less concentrated on mass-production industries of textile, electric appliances, automobiles and the like, or on the construction of infrastructures such as roads, railways, bridges, dams and etc. Housing had been left behind except the mass supply by the public sectors according to the critical demand of post-war homeless people in urban areas destroyed during the war (Fig. 1).

2. ENVIRONMENTALLY SYMBIOTIC HOUSING

2.1 Background

2.1.1 “Scrap and Build” Housing

During the last decade, the Japanese building industry has maintained an average construction level of approximately 1,400,000 dwelling units per year (Fig. 2). These homes have an average lifespan of 25 to 30 years (Fig. 3), a quite short period of usefulness compared to European or American standards. This is however not surprising for us Japanese, because the lifespan of urban timber houses used be very short due to frequent fires or to the natural disaster caused

Figure 1: Tokyo in 1945.

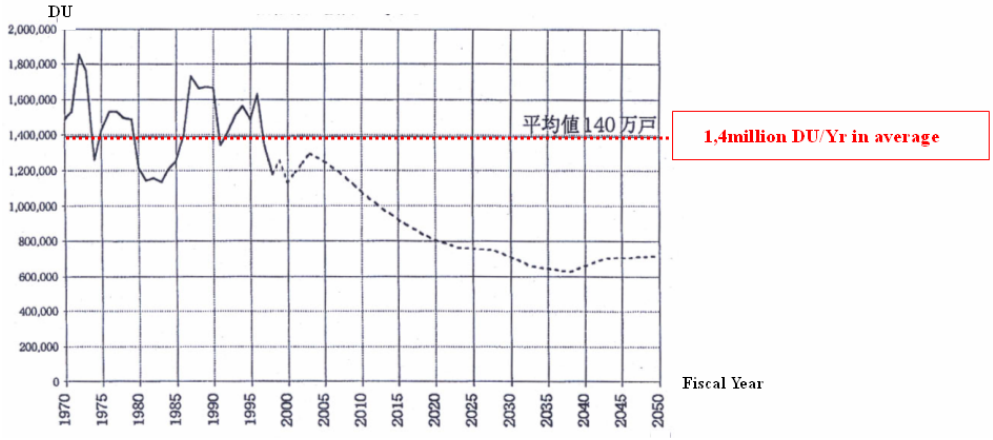

Figure 2: Annual New Construction of Dwelling Units in Japan (Mitsubishi Research Institute).

by typhoons and earthquakes.

A historian reported that the expected lifespan of timber townhouses in Edo (former Tokyo from the beginning of the 17th till the late 19th century), the population of which had already reached to one million at the end of the 18th century, was as short as merely 3 years, according to accounting reports of carpenters. They had a very quick and prefabricated rebuilding system through forestry-timber manufacturing and supply industry within a cyclical eco-system. That could just happen due to totally natural materials of houses, provided by the adjacent regions.

Such tradition could be a reason of the short lifespan of housing in Japan, however, other post-war social and administrative system, including housing loan, pricing and tax system on real estate, and high inheritance tax, were the major incentives to demolish the houses before they reach their potential lifespan. The result is the quite high proportion of new construction (55%) to renewal (45%) in terms of floor area per year (Fig. 4). Therefore, the industry’s massive output is largely dependent upon what has been called the “scrap and build” method.

2.1.2 Housing and Global Environmental Issues in Japan

While this rapid rate of housing production has been an indispensable propeller of the post-war Japanese economy, it has been a source of grave problems as well. These problems include the consumption of large amounts of energy and natural resources, most of which are imported from abroad, during the whole lifecycle of housing, and the resulting mixed disposal of demolished houses. Such issues were scarcely recog-

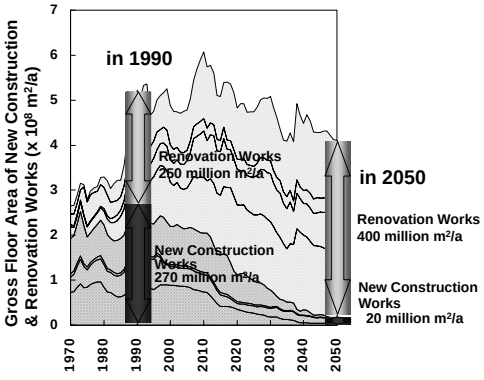

Figure 3: Assumption of Building Life Span (Yashiro, University of Tokyo, 1999).

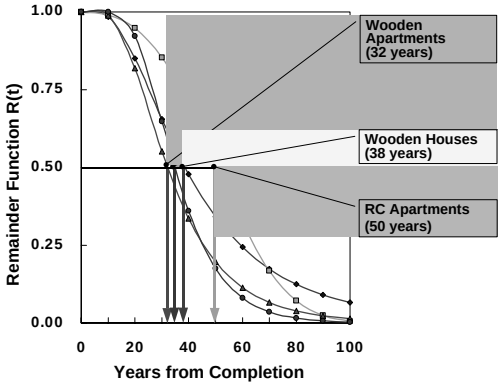

Figure 4: Decrease of new construction Works by floor area (Ikaga and Murakami, University of Tokyo, 1999).

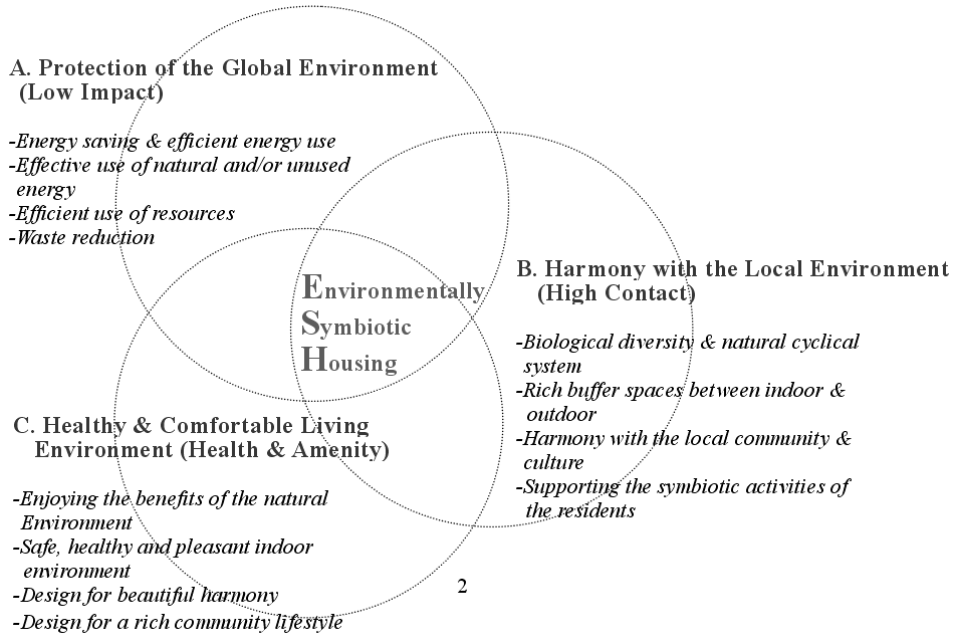

Figure 5: Three Objectives of the ESH.

nized as environmental issues, until the beginning of the 90's, when the global environmental problems became an internationally political issue, which Japan could not overlook anymore.

2.1.3 Problems of Housing Quality

It is true that post-war Japanese housing production has developed very rapidly in terms of both quality and quantity. However, the following qualitative aspects of housing bring to light the many issues still to be tackled in Japan.

- the size of a dwelling unit
- the housing durability and adaptability to region and residents
- the appropriateness of housing techniques according to region and residents
- the health and comfort of its indoor and outdoor
- the overview of the townscapes and the natural landscapes
- the cost of measures related to the above

We have been facing a decade of economical recession, and the construction of new buildings in Japan is estimated to decrease drastically in the long term (Fig. 4), high-quality housing that deals with such issues is in growing national demand.

2.1.4 Towards Sustainable Housing and a Sustainable Society

It is the responsibility of all the stakeholders, involved in housing production, distribution, construction and use, to be aware of the environmental problems confronting housing and community development. At the end of the 80's, there arose a tendency of thoughts to recognize the necessity to come up with all these issues of resource, energy, immediate loadings, health & amenities as a comprehensive environmental issue to support for the creation of a sustainable society in Japan. The former Ministry of Construction took initiative to guide this tendency towards organizing R&D group, under the banner of "Environmentally Symbiotic Housing (ESH, hereinafter)".

2.1.5 Movement of the Environmentally Symbiotic Housing

Having foreseen such a state of affairs, in 1990, a group of professionals and firms from public and private sectors joined forces, first functioning as a research body then as an organization for the promotion and realization of ESH from

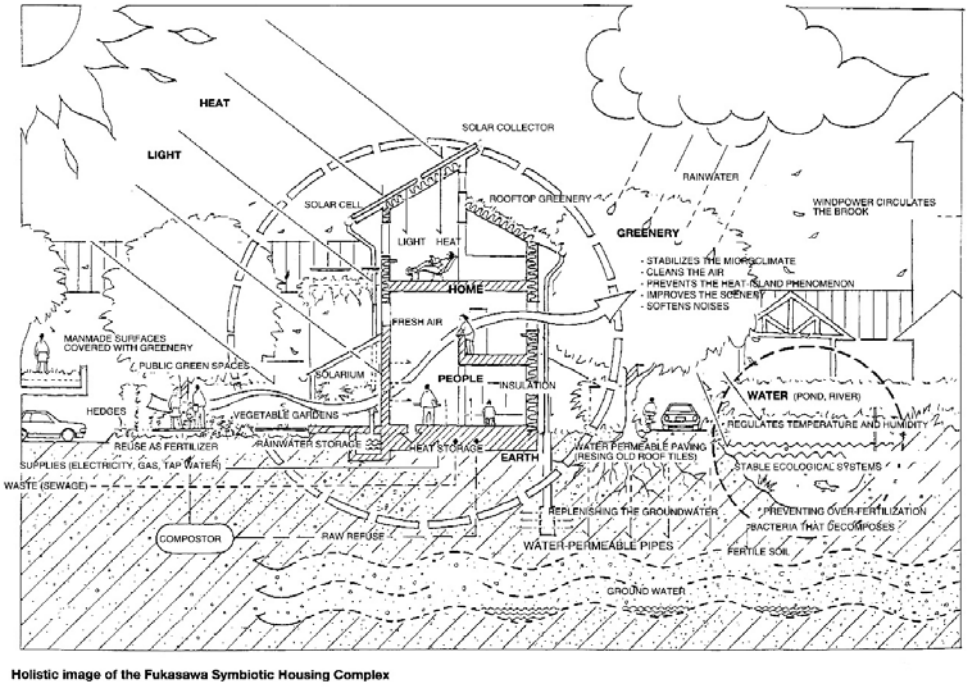

Figure 6: Holistic image of an Environmentally Symbiotic Housing (Iwamura, 1995).

north to south in Japan. For six years it studied, from a wide variety of approaches, technologies and organizational systems that help address problems in housing and community development. National subsidy schemes set up during this period has helped to carry out over sixty projects around the country. These are primarily projects by public corporations and independent groups, with the completed works playing an important role in furthering the understanding and experiencing ESH. FUKASAWA Symbiotic Housing Complex (Fig. 9, 12) is the most successful and symbolic project that was planned and implemented during this early stage.

2.1.6 Development of the Movement

This movement has already 15 years history and has been run by the Association of ESH since 1990, uniting member groups of diverse business types and conditions, design methods, construction techniques, marketing methods. Whether involved in the planning, design, production, marketing, or maintenance of housing and community, member groups share a common destination that is to investigate, propose, create, and evaluate ESH and related methods, systems and attitudes. In cooperation with the Ministry of Land and Transportation and its

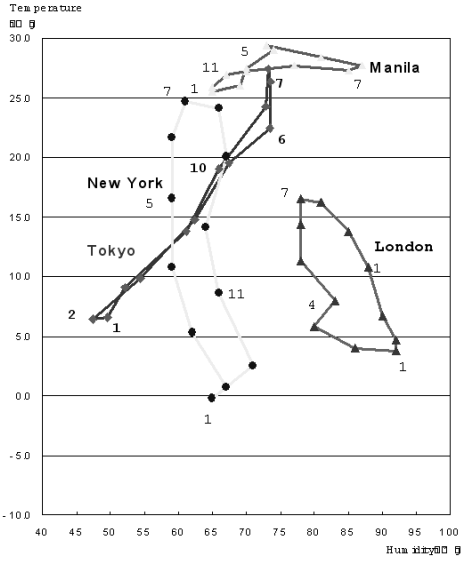

Figure 7: Climo-graph of 4 cities in the world.

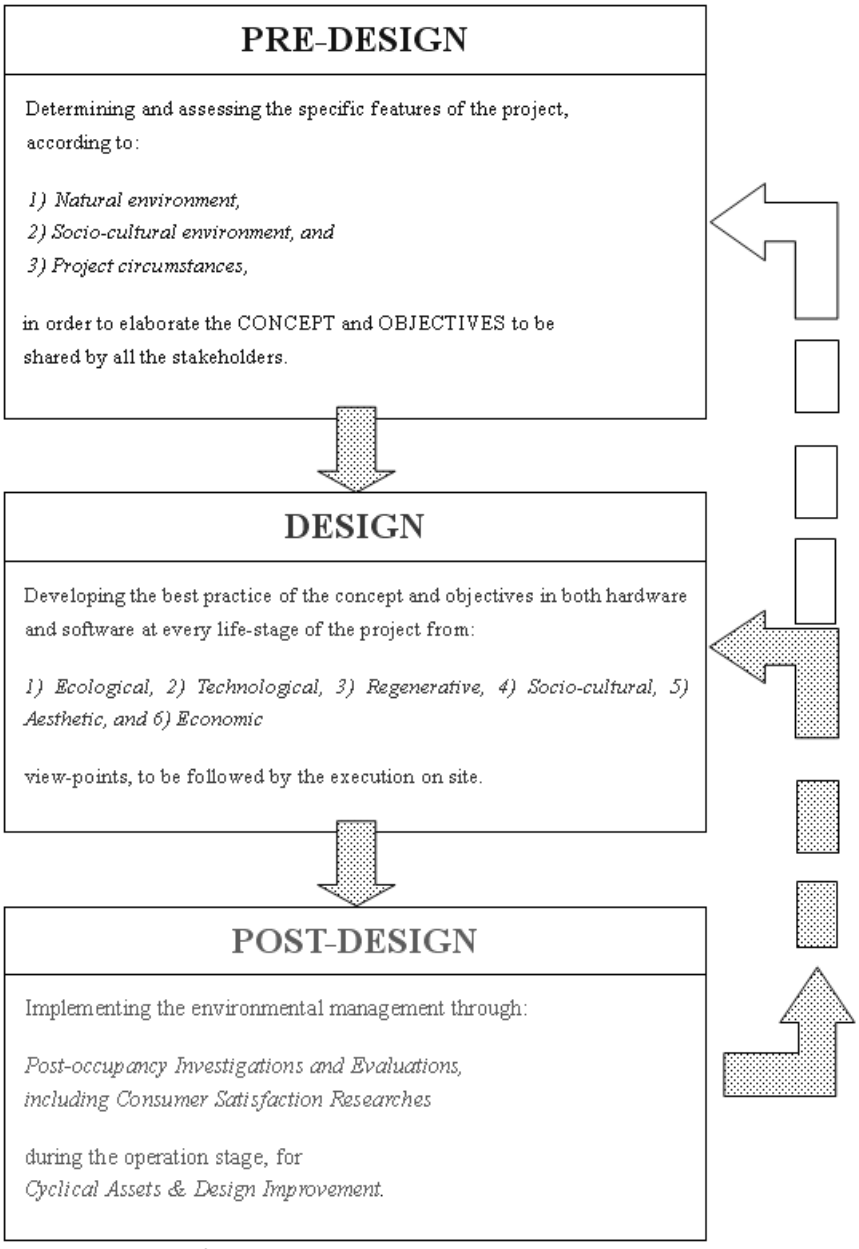

Figure 8: Cyclic Design Process of Sustainable Architecture (Iwamura, 1999).

foundation, the labeling and evaluation guideline of ESH was established in March 1999 (Figs. 5-6). Since then, more than 80 types of houses and housing complexes have been labeled and more than 3,000 accredited houses (dwelling units) have been built around the country.

2.2 Objectives of ESH

According to the definition of the Environmentally Symbiotic Housing, set by the Ministry of Construction in 1991, “the Environmentally

Symbiotic Housing refers not only to housing itself, but also to the surrounding local environment. It is developed from the standpoint of preserving the global environment by conserving energy and resources, while reducing waste at the same time. Its next goal is to exist in harmony with both natural and man-made surroundings, as well as to provide residents with amenity-rich healthy life, thus encouraging them to participate in construction process, and then taking care of the environment."

The following four themes (1-4) correspond to the three basic objectives (A-C: Fig. 5) that must be realized to achieve Environmentally Symbiotic Housing:

A. Global Issue (Low Impact).
   1. Energy Saving.
   2. More Effective Use of Natural Resources.

B. Local Issue: Harmony with the Surrounding Environment (High Contact).
   3. Compatibility and Harmony with the Local Environment.

C. Residential Issue: A Healthy Residential Environment with Amenity (Health & Amenity).
   4. Health and Amenity – Be Safe and Feel Safe.

Basic ideas of these objectives are as follows;

A) Global Environmental Protection (Low Impact)

This includes energy and resource conservation and minimum waste production in various ways and upon various levels. Such activities already have some part in most people's daily lives, but they should be organized on a neighborhood and regional scale as well, and be thought about and practiced by everybody. The huge amount of concrete rubble produced when buildings are demolished, is an example of building waste that must be recycled. Such recycling should not be planned case by case; in order to achieve a significant difference, it must be established as a social system.

B) Harmony with the Surrounding Environment (High Contact)

The etymology of the word "landscape" suggests not only the scenery of a location, but its condition in every sense, including its climate, its geography and the organisms that inhabit it. Therefore, it is essential to investigate environmental elements such as light, wind, water, earth, and organisms, and to apply the findings to development decisions. In other words, development should be appropriate to the history, landscape, and inhabitants of the site and its surrounding area. This will influence, too, the kind of community to be created there.

C) A Healthy Residential Environment with Amenity (Health & Amenity)

In building each home, everybody wants to consider how it can be made truly healthy for the inhabitants. In Japan, the relationship between housing and health has become a serious social issue. In the past we have been too indifferent in our choice when choosing building materials, construction method, air conditioning and ventilation systems, and other elements. These have the potential to cause health problems to human and other organisms, especially within spaces that are increasingly airtight. This air-tightness of housing has never been the issue in the building history of Japan, where the openness for summer's hot and humid climate was the top priority, and the idea was brought from North America to cope with energy saving. Without actually noticing it, our homes may produce chemical substances, mold, and dust linked with allergic reactions as eczema. It is as if our bodies are protesting against this careless age. The elderly, the handicapped, infants, and housewives, who spent the longest hours at home, are especially at risk.

Closely related to health is the idea of "comfort", with light, temperature, humidity, and ventilation being some of the issues that need to be reexamined. Guidelines for such reform have been discussed and formulated by the Government after the intensive campaign of media and users.

2.3 Major Topics of ESH

2.3.1 Energy and Daily Life

In the past 100 years, while the global population has multiplied by four, our energy consumption has ballooned to 25 times the original level. It is true that Japanese energy consumption per household ranges from one half to a third levels in the US, and that it is the manufac-

Figure 9: Fukasawa Symbiotic Housing Complex in Tokyo (Iwamura, 1997).

turing, transportation, and business sectors which consume the dominant share of energy in Japan. However, we have not been aware enough of how our daily energy consumption affects national energy policy – and the global environment.

For, while the industrial sector, ever since experiencing the oil-shock of the 70’s, has been doing its utmost to achieve efficient and low-level energy consumption, consumption in homes has been allowed to grow at an alarming rate, in the continual search for greater convenience and comfort. Clearly, our increasing use of electrical appliances and the widespread use of air conditioning and boiler for warm water supply will soon make us into high-level energy consumers in the world. The Government’s “Global-warming Prevention Action Plan (1990)” warned of such a strong tendency, calling for the use of natural or untapped energy sources in our daily lives.

However, within the field of architecture and housing, a misguided convention dictates that “energy” is an issue, only related to the equipment planning and engineering. Thus, no matter what kind of form or space a building has, it has become normal building procedure to consider the creation of comfortable interior environment as a function specific to the equipment design. In the past, indoor environmental control was achieved through techniques based upon knowledge of climatic and geographical conditions of the site, independent of building machinery. Instead of studying and increasing this rich heritage, we have in recent years all but discarded it. Since the 70’s, those advocating the “Passive Solar House”, a house built to use the solar energy to supply the residents with daylight, heat and hot water, have been steadfast exceptions to this trend. Now, people have started to choose passive solar techniques again, as a sustainable and symbiotic alternative, although they still belong to the minority.

Nevertheless, at base the problem of daily energy consumption is intimately connected to how we, as individuals, think and act. This is perhaps why the ideas of ESH are often expressed in the language of lifestyle.

2.3.2 Resources and wastes in daily life

Inseparable from the problem of energy are those of resources and of waste disposal. We must consider these issues both in terms of the materials and equipment that make up the housing itself, and in terms of the resource consumption and waste production that occur within the occupied building. For example, houses built in and around Tokyo are said to have an average

Figures 10, 11: Yakushima Symbiotic Housing Complex in Kagoshima (Iwamura, 2000).

lifespan of twenty years. Most large housing complexes have become thirty or forty years old, and are reaching a stage where they must be rebuilt. But the terminal garbage disposal sites near Tokyo are filled to capacity, and the tremendous amounts of industrial waste materials caused by rebuilding is already a serious problem. Nowadays, some of the discarded concrete is ground up on the demolishment site and reused as building material, but it is vital to start thinking at the planning and design stages, about the cyclical use of resources, taking into consideration the longevity, disposal and recycling of each material.

Also, now that there has been a move towards requiring those who produce large amounts of household garbage or sewage to cover the excess costs, people are beginning to realize that each individual must work for lower levels of resource consumption and waste production. The recent frequent shortage of water and other emergent situations have highlighted the need for using rainwater, gray water and other alternatives.

2.2.3 Locality and the building industry

The relationship between a region's characteristics, climatic conditions, and the housing is important in urban and rural areas alike. This is the very basic premise of ESH. Similar to Feng-Shui philosophy, it involves studying the land's climate (Fig. 9), topographical and geographical features, flora and fauna, and finding out what kind of effects these characteristics have upon the locality as a living environment. The qualities of a region are best brought to light by considering both the social and geographical viewpoint, with aspects of biology, geography, geology, meteorology, and sociology all contributing to the necessary fieldwork. This is a traditional way of designing housing, only recently being rediscovered.

There is however a problematic gap between such an ideal planning process (Fig. 8), and the present architectural production system that is called on to bring the plans into reality. The building parts and materials being marketed now are based upon mass production and mass sales, and even if the plan itself requires sensitivity to local social and economical structures, there are certain conditions that make it difficult to avoid using such products. For example, although timber is a renewable resource abundantly present in Japan (although ca. 75% of the land is covered by forest and the post-war policy had driven everywhere to plant Japanese cedar for timber industry), domestic timber cannot compete in the international market with cheaper import. Consequently, three forth of the lumbers used for house building are shipped from North America, Oceania, Russia and elsewhere, creating a cycle that only speeds the decline of the domestic timber industry. This creates also a critical ecological imbalance in forests and deteriorates the very important function as natural dam. To mend this absurd situation where wood is said to come from "the sea", not from "the mountain", not only must the Japanese timber industry rationalize its production and marketing systems, but also help to inform potential users about the related background and qualities of wood. People should not be choosing a veneer facing over real massive wood, for example, simply for the sake of its straight grain appearance. This belongs also to cultural issue that requires educational movements from the childhood of users.

2.2.4 The site and its local environment

Housing, like any other building, occupies a certain piece of land, i.e. the site: this obvious fact is allowed to determine much in the building of ESH. In other words, every site is connected to others, and is a part of a local space environment. It is therefore extremely rarely that something can be built based upon a single set of priorities and conditions.

Also, the greenery, soil, and water on a site are an integral part of a shared, regional ecological resource. Water, plants, and animals do not confine themselves to one plot of land, but flow, grow, and move about. The prevalent attitude that landscaping and gardening have been considered as "extra" or added aspects to architectural design must be changed. Regardless of whether the building site is in the city or in the suburbs, water, plants, and animals should be acknowledged altogether upon a wide ecological scale, and considered integrated into the architectural design to be symbiotic with the environment on all levels (Fig. 6).

2.2.5 Technical elements and planning methods

The techniques necessary to build housing fall

under a multitude of categories, from landscape, garden, and exterior finish, to the building itself, and the home units within. There is a multitude of passive architectural design elements, and active use of high-tech efficient mechanical parts, even counting only those elements that have to do with saving energy through insulation, air-tightness, and day-lighting for instant.

However, problems can occur, ironically, when these elements become too much effective in themselves. For example, when we achieved air-tightness associated with insulation as an energy saving technique, which was so far not familiar to housing design in Japan, we began to experience the problem of critical indoor air-quality and inside of the walls, because the need for ventilation was often ignored as usual. Till recently, too, not much attention was paid to the ill effects of certain chemicals such as volatile organic compounds upon the human body. When we forget to see technical elements as parts of the whole home, and concentrate upon making them individually successful, they tend to become statistically impressive ends in themselves, and harmfully removed from the very needs to be fulfilled for the sake of healthy daily lives and physical beings of the residents.

The technical elements must support the living environment in a balanced, holistic way, based firmly upon the residents' daily needs. Many fields of knowledge overlap in the conceptualization and design of a living environment, and a wide variety of those related knowledge should be incorporated in the design. It is vital, therefore, to learn from traditional and local building methods and materials, and to combine them with the latest technology appropriate to today's requirements of the residents' lifestyle. As was mentioned before, the determining factors are the zeitgeist, the characteristics of the society or the community, the land itself, and the residents as users, to be reflected in the design as a holistic and cultural action.

2.2.6 Housing, health and physical life

The above stated environmentally symbiotic technologies are designed to bring health and comfort to the residential environment of both indoor and outdoor. The question is what is healthy and what is comfortable? The market of building materials and equipment has an incredibly wide variety, and they promise to create a "healthy and comfortable house" irrespective of the user's individual needs or of the site's characteristics. Recently, however, the relationship between indoor air quality and residents' health has become a serious issue of the whole nation, especially as homes are built to be more and more air-tight, thus increasing the problem of indoor air pollution, caused by formaldehyde and/or volatile organic compounds, to cause allergic reaction like eczema.

In terms of creating comfortable temperature and humidity levels, the modern technical elements, such as an air conditioner, used now excel, but the success is often combined with a harmful incompatibility to the Japanese climate and lifestyles. Therefore, the problems of indoor air pollution have grown with popularity of such equipment. Toxic chemicals, microbes, and bacteria which exist in building, building materials and equipment, are among the reason why the design basics, including material selection, air conditioning and ventilation, must be reviewed from the vantage point of human physical well-being.

Figure 12: Fukasawa Symbiotic Housing Complex.

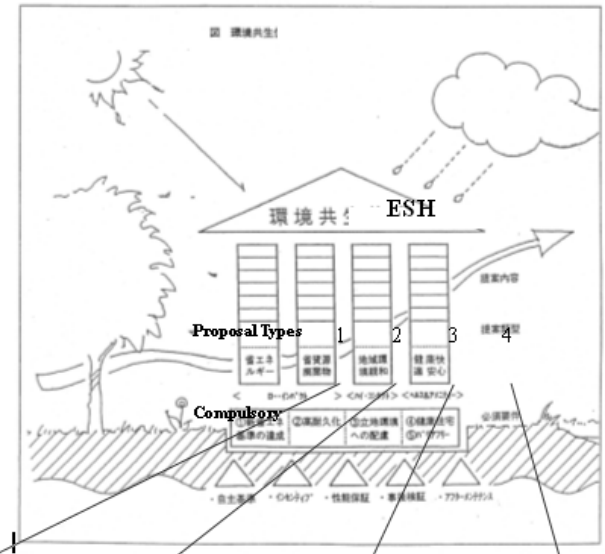

Fig.14 The Basic Frame of the Environmentally Symbiotic Housing Evaluation Guideline (as of 1999)

Proposal Types	1.Energy Saving	2.More Effective Use of Natural Resources	3.Compatibility and Harmony with the Local Environment	4.Health and Amenity – Be Safe and Feel Safe
Proposal Contents as Examples	1) Greater efficiency in reducing heat losses 2) Greater efficiency in controlling solar radiation capture 3) Passive use of solar energy 4) Active use of solar energy 5) Efficient use of unused energy 6) Use of highly efficient equipment 7) Miscellaneous	1) More durable skeleton 2) Structural and building methods for flexibility 3) Low emission 4) Active use of recycled building materials 5) Highly effective use of water resources 6) Sorting of household wastes 7) Miscellaneous	1) Better harmony with the local ecological system and environment 2) Greater consideration for the natural water system of the area 3) Greening efforts 4) Creating rich buffer spaces between indoor and outdoor 5) Greater consideration of townscape 6) Integration of the local culture and regional industry 7) Miscellaneous	1) Through universal design both indoors and outdoors 2) More suitable and adequate ventilation 3) Through choice of safe and eco-materials 4) High sound insulation efficiency 5) House performance guarantee though ongoing property management 6) Information services on housing 7) Miscellaneous
	Low Impact		**High Contact**	**Health & Amenity**
Compulsory Performances	(1) Conformity to the Energy-Conservation Standard as of 1992	(2) Long-life Durability; Conformity to the GHLC* Standard as of 1998	(3) Consideration regarding the surrounding environment	(4) Conformity to the guideline for indoor air quality (5) Conformity to the barrier-free design standard of GHLC*

Figure 13: Structural Image of the Environmentally Symbiotic Housing Evaluation Guideline (Iwamura, 1998).

When testing building methods and materials for the energy efficiency, we should also remember the basis of our physical life, that are the five senses with which we human beings percept the world. Production, sales promotion, and design concerns must not eclipse the importance of the residents’ sensory perception at home. On the other hand, the residents’ concerns to share the awareness of such aspects have been very weak. What is needed right now

is the development of building elements and materials, and of engineering and building techniques, that is sensitive to such "invisible environment" and to human physical life.

What people consider "comfortable" or "uncomfortable" depends very much upon individual physical characteristics (age, sex, or medical history), as well as upon childhood or recent experiences with houses, and even the person's mood of the moment. Especially in Japan, the "standard" of comfort is a complex one, for ever since the Meiji restoration of the late 19th century, lifestyles have been formed by inherited traditions on the one hand, and on the other by attitudes and architectural forms brought from the admired occidental countries of "advanced cultures". When different value systems are thus mixed, it is difficult to decide what comfort really consists of. It is, too, quite recently that the administrative housing policy has begun to shift its post-war emphasis on quantity, onto quality.

Another point is that residents are not a homogeneous entity, and their standards of comfort are varied and complex. For example, when trees are planted to create a pleasant green area, some people consider the job of sweeping up the fallen leaves an annoying bother, while others consider it a matter of course. Some dislike fruit-bearing trees because they attract wild birds, which might dirty the house or laundry, while others enjoy this presence of nature in their lives. Thus, our ability to lead a comfortable life while being ecological, or while enjoying neighborhood relations, depends upon our attitudes towards what is "too troublesome". This is an age where large service industries such as door-to-door delivery services or 24 hours convenience stores offer to free us of the need to perform bothersome tasks. We city dwellers who have gotten accustomed to such systems need to change our own attitudes. Again, it is not enough to perform just techniques or administrative systems.

2.2.7 Cost and lifecycle

A cost analysis is indispensable within the process of realizing and popularizing the kind of systems and movements mentioned above. The alleviation of regulatory politics concerning building specification and the higher efficiency of transportation in recent years create corresponding adjustments in the initial, running and maintenance costs of building. In addition, as we run out of waste disposal space, the cost of recycling or otherwise dealing with dismantled building wastes has become a serious issue. The lifecycle cost of what we create has been already in the list of discussion. Tens of thousands of components and materials are composed to build a modern-day home. The initial cost of these products and their running and maintenance cost must be considered in conjunction with how their qualities will affect the lifetime of the home, and the cost of the home's eventual disposal. Only such a whole can the true cost of a home be evaluated.

The "environmental value" or "hidden cost" often talked about these days stem from the idea that the "value" of a thing is not simply the sum of its basic cost and profit, but that the environmental loadings the thing will cause during its production and distribution should theoretically be a part of the value analysis. True costs can only be determined and meaningfully compared with each other, when all these elements are considered together. Simply put, if someone, somewhere, is causing harm, the damage should be assessed and the perpetuator billed for it.

This way of calculating "cost" has not yet left the conceptual stage, since standardized guidelines have not yet set, but the underlying stance is one that should be generally adopted. It is useful to remember, once more, the fact that "ecology" and "economy" have shared etymologies.

2.2.8 From a passive maintenance to a active maintenance for the sake of maturing process of a building

The life of a home begins with the initial construction is completed, In the course of time, residents' lives and neighborhoods grow, change and flourish. In the environmentally symbiotic housing, we are struggling to establish both conceptual and concrete frameworks that support such a lifecycle through nurture and maintenance, while building a sustainable living environment.

For example, we depend greatly upon greenery to create a pleasant neighborhood environment. This tendency is quite far from the general attitudes that consider greenery as an annoying (i.e. expensive) liability, and where the

classical problem is; who, whether in the public or private sectors, will carry the cost of maintaining it?

A basic step in solving this problem is for every resident to accept a part of the responsibility in carrying for the housing and its immediate surroundings. The residents should, with the help of the administration, cooperate in forming community rules that determine what needs to be done to what extent, and by whom.

Architecture, and especially housing, is not "finished" simply when the building is completed. In a society of "stock economy" like that of the occidental countries, the real-estate value of a well maintained and matured home could be higher than that of a newly built home. This is not at all so in the case of Japan's "flow economy" – a state we should be questioning and working to change. Facing the ten years economical recession, in which even the land price has generally dropped everywhere, it is time for us to answer the questions thrust to our attention by the Great Hanshin earthquakes in 1995, about the role of "stock" architecture and "stock" community-making.

2.4 In Conclusions

When we thus think about housing from the vantage point of symbiosis with the environment, the problems that plague modern housing – and architecture in general – become obvious. Along the path of progress, we have thought fit to discard or forget the traditional ways of living that were based on biological knowledge. These methods were in fact protecting the richness of the environment, supporting the continuity of peoples' lives through the preservation of ecological balance. While solving these problems in one sweep would be an overwhelming and difficult task, it is important to start with things we can do in our immediate surroundings.

In the aftermath of the Great Hanshin Earthquake, when we heard of how the victims reacted to this hitherto unthinkable disaster with spontaneous, local cooperation, we were made to recognize how important it is to build not only large-scale systems, but also smaller, independent systems of energy and water distribution. It showed us, too, in an extremely striking way, the true meaning of "living together" with our neighbors, and the importance of maintaining strong ties with each other. When a neighborhood is created through participation by all the residents, such relationships could develop and flourish. In order to realize a sustainable society and development, the element of human relationship is impossible to ignore.

The issues concerning ESH touched on above are not extraordinary in themselves. They are basic ideas from which most discussion on housing and neighborhood start. It is time to use these ideas, reconstructing our techniques, administrative systems, and attitudes accordingly. Key issues for sustainability are embodied in the local context, which should be discovered through the cyclical design process and the collaboration.

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