

Panel Report 1

## Japanese Perspective of Environmental Business Utilizing Biomass

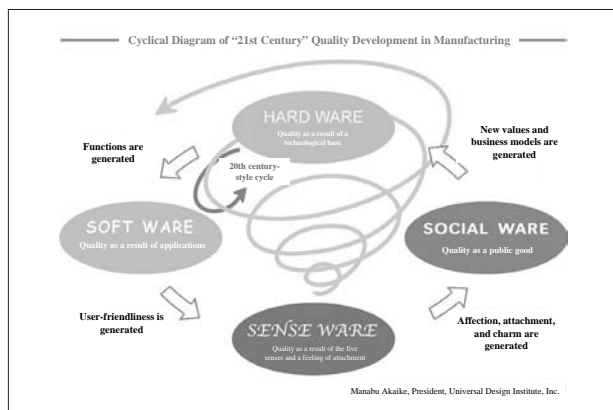
Manabu Akaike

Director, Universal Design Intelligence, Inc.



### 1 Circulatory Development of "21st Century Quality" in Manufacturing

Our research institute develops products, facilities and communities based on eco-design and universal design concepts. I will be speaking today about the future of the eco-business and particularly approaches to the biomass business from my position as a producer of eco-friendly designs.



Slide ①

This is a view of the circulatory development of "21st century quality development" in manufacturing. According to this conceptualization, in the process of developing products or the eco-business, designing and planning circulate through the four wares you see here - "hardware", "software", "sense ware" and "social ware" - to enhance value in a spiral motion. I see this as the principle path to manufacturing and development in general.

For example, with wood biomass, it has been a question of what kind of hardware would be effective. For example, the flow has been to research cellulose and lignin, make biodegradable plastic from

polylactic acid, or to look for effective plant technologies that would enable thermal cycling. The blind spot of the eco-business or biomass business has been to overly focus on hardware development without asking what sort of other applications might come from simply converting fallen lumber into electricity by burning or converting it into biodegradable plastic. Technological systems have been undertaken without sufficiently discussing alternative applications. This is the cause of unsustainability that Dr. Seldman spoke of. It is important to design and develop applications for biomass resources that meet local needs and are tailored to the peculiarities of the local area.

Next there is sense ware, which is to combine added value with high marketability. For example, there will be need for products that drive the five senses and enhance accessibility, as well as efforts to deliver the type of quality exemplified by environmental justice and environmental dignity, which again Dr. Seldman spoke of. Furthermore, this kind of approach should be designed to lead to business models that will benefit the primary industries as well as the tertiary service industries, which includes waste processors, and then the quality of such business models should be appealed in terms of social ware and public welfare. Again, designing a circulatory structure that produces technological development based on this type of new business model is necessary in the next phase.

Much of the development of today's eco-business began with the hardware undertakings of governments, universities and Technology Licensing Organi-

zations (TLOs). Nonetheless, our research institute has, for example, been working on developing solutions for the "sick house syndrome" since 1992. The sick house syndrome is a social problem; therefore we directed our thoughts at how technological development could solve that and what sort of design an environmentally healthy house might have, as a theme of social ware.

Also we have suggested to a major automobile manufacturer that, since there is a sick house syndrome, there could someday very well be a "sick car syndrome". A number of volatile organic chemicals (VOCs) are used for interior accessories inside cars. Moreover, ticks and mildew can proliferate from the snacks that kids leave behind, whereby leading to allergies from animal allergens. Or, various contagious diseases could come from the dried state inside the vehicle cab. After, being aware of the problem of a sick car syndrome, various technologies for "health of cars" have been developed to solve the situation, which has suggested a solution for adding the value of cars and in post-safety and eco-friendly era. As a result of social ware development, the automobile manufacturer is now successfully improving the interior performance of their cars through a sense ware type commercial.

## 2 Design Examples That Add Sense Ware and Social Ware

### 2.1 Sazanami Series of Cypress Flooring

**Hinoki (Japanese cypress) Romance-style interior finishing material Sazanami (rippling waves) Series**

Conventionally, wooden flooring and wall materials were finished with flat surfaces. In this series, the surfaces of these materials are carved into traditional hatchet and Kamakura carving patterns which take advantage of the sense of depth and the natural tree rings of genuine solid wood to generate a naturally textured feel. These completely new interior finishing materials can be used in a wide range of applications. In addition, mass-producing the surface cutting, polishing, and coating processes ensures the stable supply of these materials. The coating materials used on these products offer a superior level of safety, and do not contain toluenes, xylenes, or styrenes.

**Product features**

1. When used as flooring material, the product offers a tangible sensation upon walking, is anti-slip, and helps to guide the walker.
2. The product is visually interesting, with play of light and shade.
3. The surface finish is possible only because the material is solid wood. The material is natural and healthful.

**Design features**

1. The light and shade of the highly textured surface finish gives a visual effect like that of rippling waves.
2. The highly textured surface finish generates tactile effects such as the tangible sensation of walking.
3. By combining the use of this product with conventional, flat surfaced materials, the effects of both materials are optimized.

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Slide ②

Next, I would like to introduce some specific examples of products. In order to maintain Japan's forests, it is necessary to develop lumber products from thinned small diameter trees. However, confronted by low cost imported materials, this native lumber is not competitive and cannot be profitable --- that is how it was looked at under conventional thinking. But, as you can see by this slide, with a little creative ingenuity and consideration for sense ware, not only can the design be improved but also floor materials can function as a guide path as you can see here. In other words, this is a universal design floor material, which is marketable. This product hit the market first in Kumamoto Prefecture and is now being widely used by public facilities all over Japan.

### 2.2 Kenko Hinoki Tatami (Healthy Cypress Mat)

**HIDA FOREST** <http://www.hida.fc.jp>  
Hida Forest Co.: "Healthy Hinoki Tatami Mat"

Hinoki (Japanese cypress) is a type of wood with a unique, pleasant scent and a variety of effects. The scent of hinoki helps to fight tree rot-causing bacteria, holds down the breeding of house mites, and maintains the indoor environment in a healthy state. Fresh fish products are placed on hinoki leaves to take advantage of the hinoki's ability to control the proliferation of mold and bacteria, prevent oxidation, and keep the food from spoiling.  
Note: For the first several months after they are laid down, these tatami mats give off a strong scent of igusa (rush plant). The sensation of smell varies with each individual.

In addition, the scent of wood has been proven to produce a state of relaxation (forest bathing effect), and the fragrant ingredients are widely extracted for use in a variety of products, including air fresheners, bath salts, mouth repellents, and antimicrobial agents. Hinoki is generously used in our hinoki tatami mats, which offer these kinds of forest bathing, mouth refreshing, and anti-robe-fighting actions.

**Superior durability and longer life compared to mats made of straw**  
We compared the durability of hinoki tatami mats with that of conventional tatami mats made of straw. The average straw tatami mat becomes uneven, lumpy, and depressed on the surface with continued use. However, the hinoki mats last longer while maintaining a pleasant cushioning sensation. On the long run, hinoki mats are cost-effective and contribute to the effective use of limited resources.

**Trimming mats burns in the forest?**  
Hinoki tatami mats consist primarily of sliced wood chips, which are produced from thinned and/or small-diameter hinoki trees. Thinned trees are trees which are harvested when forests are thinned out. After sapwood is removed, the growing trees must be thinned periodically. The thinned trees for the growth of large trees which can be used as pillars in residential buildings, while also protecting the forest from landslides and related disasters. At Hida Forest, we make the most of our limited natural resources, doing away with leftovers in a revolutionary production method to create a high-quality tatami mat. (Point printing.)

**Environmentally friendly**  
Since they are made of natural materials, hinoki tatami mats are easy to dispose when renovating the building. Even those used in the store, and after return to the soil. Incubate them, and they generate no toxic substances such as chlorine. The tatami mats are created with the theory of natural movements in mind, and feature the minimizing use of natural materials. The product was approved as an Eco-Mark Product in 1995.

Slide ③

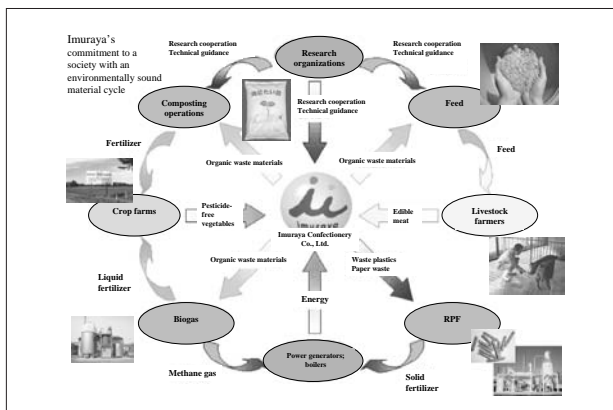
Next, I would like to introduce a mat as an example of social ware. Flooring mat is called "Bouchu-tatami" or "insect-proof mat". Though mats that reduce ticks and mildew with chemicals by impregnating with organophosphorus agent, this is one of the major causes of sick house syndrome. As a solution, the "Kenko Hinoki Tatami" or "healthy cypress mat" was developed. This floor mat is made from waste chips generated from cypress lumber production as opposed to straw flooring mats. Cypress has a natural insect resistance; therefore, in addition to the fact that it prevents the spread of ticks and mildew without being charged with organophosphorus, it also has a

fresh pleasant fragrance and is thus a hit product.

The mat itself benefits the consumer because it solves the sick house syndrome. For the local forest cooperative and material manufacturer, it turns what was once waste chips from flooring production and cost money to dispose of into a hit product that makes money and adds value to the waste. As such, the mat has proven beneficial to the local forestry business and is, therefore, a good example of the hidden social value found within the mat.

With this kind of approach, a product is developed and functions as an engine for building a sustainable industrial system in cooperation with local businesses. We are involved in developing systems such as this with various communities.

### 2.3 Undertakings for a Recycle-Oriented Society with Imuraya



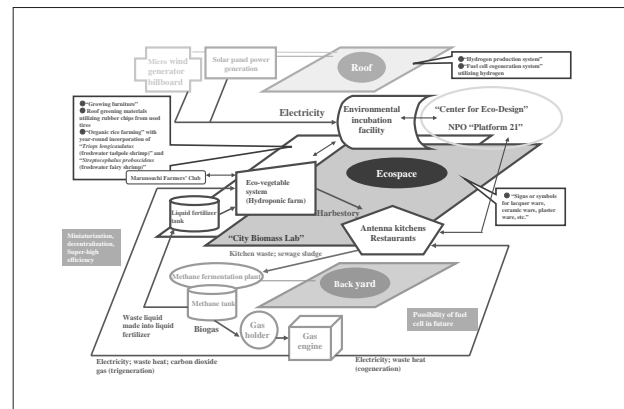
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Next, I would like to speak about an example from Imuraya Confectionaries, a large processed food company in Mie Prefecture. They generate waste in the form of food scraps, so they formed a joint venture company with a local waste handler, each owning a 50% share, to make compost as shown in this slide. The resulting organic compost is used by producers to grow organic onions and make organic teas. This kind of organization is developing into a value-added business that purchases organic materials in order to develop new organic products. Moreover, from the aspect of hardware development, biomass is being

used for methane gas and power generation. Recently, the digestive liquid produced from methane fermentation has been used to grow algae and raise high quality fish fry in the farm. This is an example of environmental relations business within local communities through collaboration with a local venture company.

### 2.4 Biomass System for Large Cities

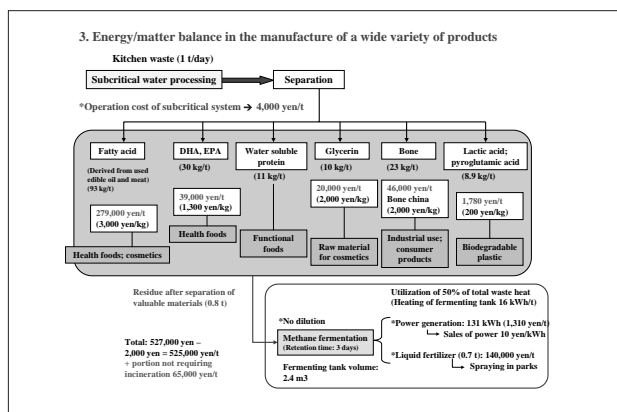
We have also been involved in developing these kinds of local biomass systems in numerous ways. In thinking about the ways for environment enlightenment, we have long been exploring how to design a biomass system for large cities, which are important in terms of dissemination of information on environmental systems and symbolic significance.



Slide ⑤

This is the local environmental system being worked on in Marunouchi, Tokyo. It has natural energy such as solar power generation seen in the upper right-hand corner of the slide and billboards that run on micro-wind power generators to prevent strong winds blowing through the tall buildings. Also, restaurants in the Shinmaru Building of Marunouchi generate 4 tons of raw waste everyday, which was previously entrusted to a waste handler but is now used for biomass power generation via methane fermentation, shown at the bottom of the slide, and the liquid compost that results from this process is being used for vegetations in Marunouchi. It could also be used for an enclosed hydroponics system right in the middle of Marunouchi, like the urban agriculture that Dr.

Seldman spoke about. And, here on the left side of the slide is the "Marunouchi Farmers' Club", which is a members' club of individuals who grow value-added crops after five o'clock instead of going to work out at the gym.



Slide ⑥

Marunouchi has the most expensive real estate in Japan, therefore a conventional power generation system fueled by methane fermentation, which would require a great deal of space, like the one in Yagi-cho, Kyoto, would be impractical. After various studies, we suggested a raw waste pretreatment plant that utilized "sub-critical water." By treating raw waste with sub-critical water, the hydrolysis level increases, which is effective for separating oils and liquids. By capitalizing on this characteristic, valuable substances known for promoting cerebral health such as docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) can be extracted from raw waste and developed as a business. Also, bone material can be removed to be used as ceramic construction material. It is important to develop business from pretreatment stage so that the concentrated organic acid that is left over can be effectively used to generate power in a limited amount of space. And, these ties in with the digestive liquid I spoke of earlier, urban greening and urban agriculture. In this way, business cost should be considered as a whole.

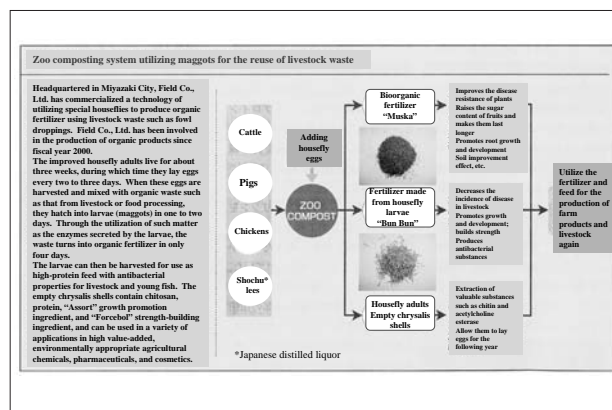
This kind of sub-critical water pretreatment plant for biomass is now being exhibited on the first floor of the Otemachi Building in Tokyo. Situated around

the showcase of biomass plant are indoor greenery and miniature urban vegetable gardens that are integrated with the plant. Also foods with various functions are available from all over Japan. I hope that you will have a chance to drop by this urban-style "biomass cafe," Otemachi Cafe.



Slide ⑦

### 3 Use of Insect Resources



Slide ⑧

Lastly, I would like to talk about the future applications of biomass. I am personally interested in "insect resources". As you well know, insects account for three-fourths of all animal species. I told you about the organic compost business of Imuraya a short while ago. The mature compost that growers use takes about two months to develop the microbial action of raw waste, stir it with a shovel car and blow it with air. And this process is sped up with insect, horseflies taking advantage of a breakthrough biomass technology called "zoo compost system." With

eggs of horseflies on the manure and garbage, two days later the maggots are born. Then, these maggots ripen the compost in just three to four days. When the compost ripens, the maggots escape as they dislike the heat of fermentation. We are currently working with poultry farmers to use the maggots as feed for their chickens. The chickens that eat the maggots grow strong and healthy, so the meat is being sold as high quality poultry at Mitsukoshi Department Store in Nipponbashi, Tokyo.

Within this train of thought, insect sciences and technologies can be applied to develop systems for zero waste cascade businesses that Dr. Seldman talked about.

At present, maggots from zoo compost are being used as livestock feed, but the maggots and goliath beetle larvae that live in bacteria-heavy soil produce large amounts of antiviral proteins that can be used against bacteria, therefore they are a rich source of substances effective against hospital infections such as methicillin-resistant *Staphylococcus aureus* (MRSA). Compost can be produced to promote organic farming in local areas and, at the same time, medically effective substances produced by insects can be turned into a successful business of developing a new drug. And the zero-emission effort like this can be com-

bined with insect genome technology. I see this is one of the future options for promoting sustainable biomass business in Japan, which has rich insect resources.

**Biosynthesis of defense-related protein**

**Antibacterial proteins identified at the National Institute of Agrobiological Sciences**

Antibacterial protein	Organism in which protein was identified
Secropin B, D	<i>Bombyx mori</i> (silkworm)
Attacin	<i>Bombyx mori</i> (silkworm)
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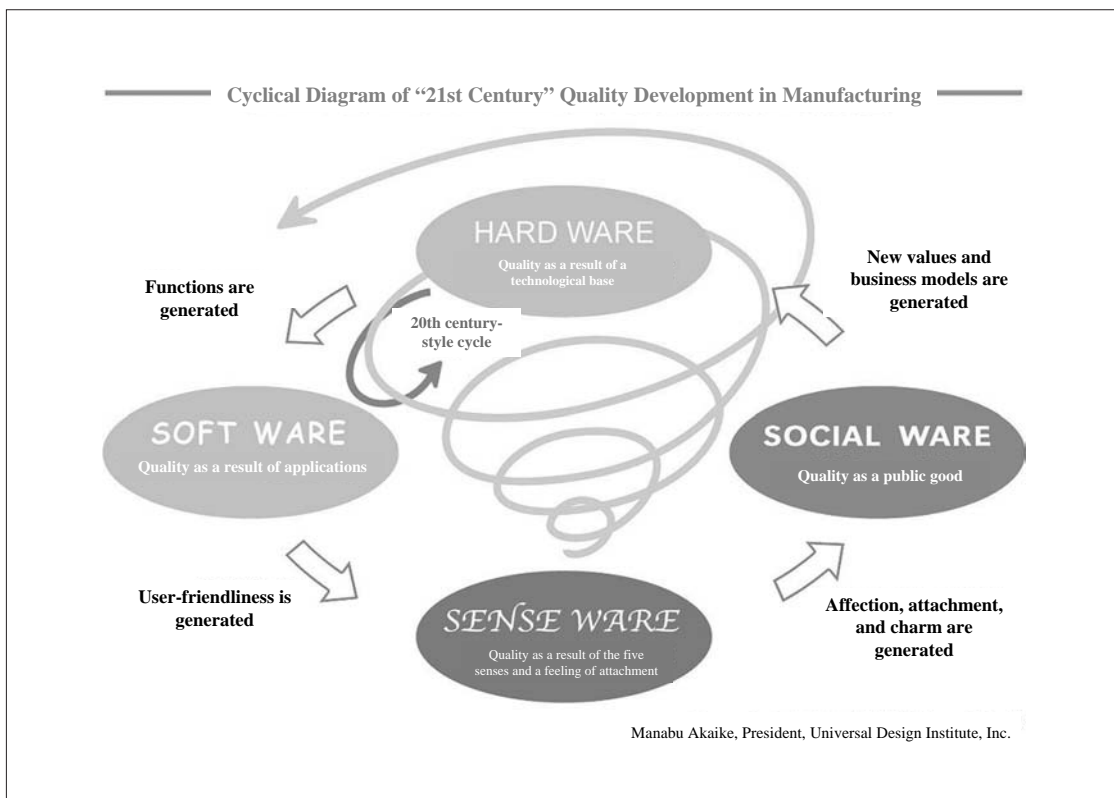
In addition to the above, over 200 varieties have been identified worldwide

Defense-related proteins are a general term for proteins which are produced by organisms to defend themselves against microorganisms such as bacteria. Antibacterial proteins are well-known examples.


Slide ⑨

In any case, this kind of attractive, hot and sustainable ecological programs of public empathy require the cooperation of local businesses and universities, and the investments by local businesses, regional financing, venture capital and private investors will have to be carefully managed. Within all of that, business models that progressively incorporate residents' funds and the like will be built. Designing the business models and managerial systems for a local area involved in such a business will be the most viable option for eco-business aimed at reactivating local communities.





Slide ①



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**Sazanami (rippling waves) Series**

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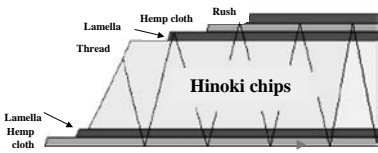

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Slide ②

## HIDA FOREST

<http://www.hida-f.co.jp/>

**Hida Forest Co.: "Healthy Hinoki Tatami Mat"**

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**Superior durability and longer life compared to mats made of straw**

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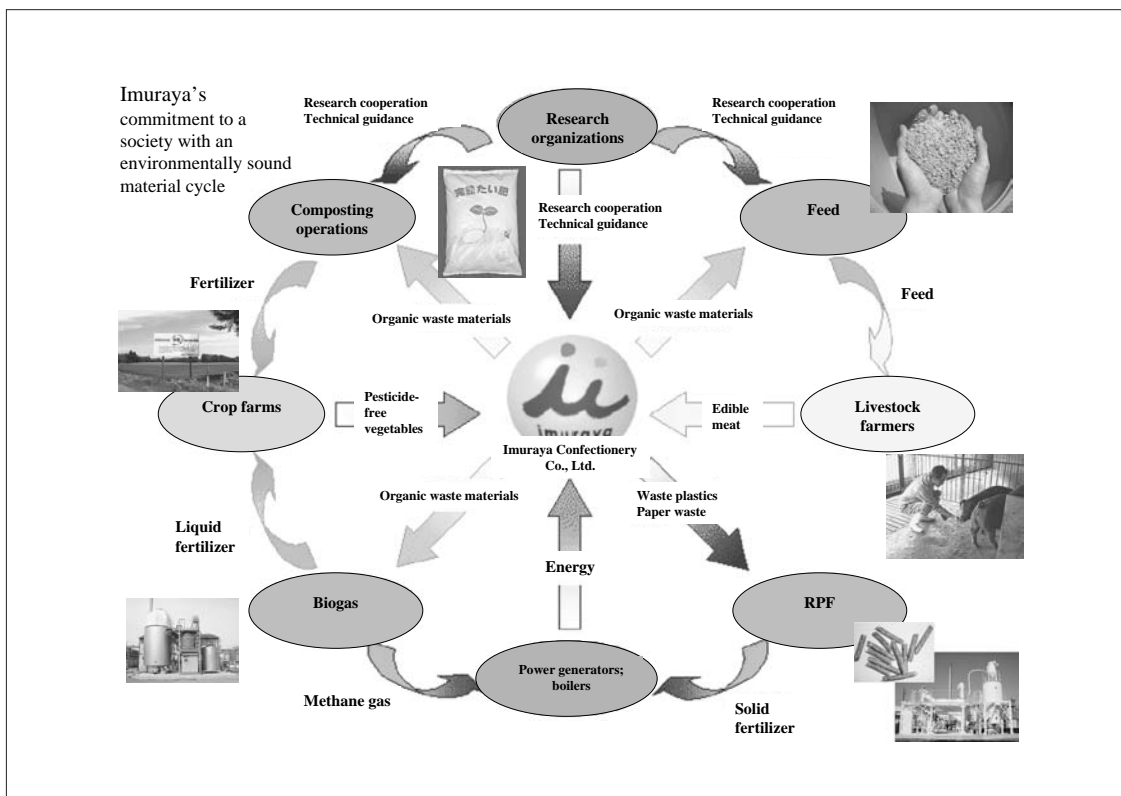
**Tatami mats born in the forest?**

Hinoki tatami mats consist primarily of sliced wood chips, which are produced from thinned and/or small-diameter hinoki trees. Thinned trees are trees which are harvested when forests are thinned out. After saplings are planted, the growing trees must be thinned periodically. The thinning allows for the growth of large trees which can be used as pillars in residential buildings, while also protecting the forest from landslides and related disasters. At Hida Forest, we make the most of our limited natural resources, doing away with adhesives in a revolutionary production method to create a high-quality tatami mat. (Patent pending.)

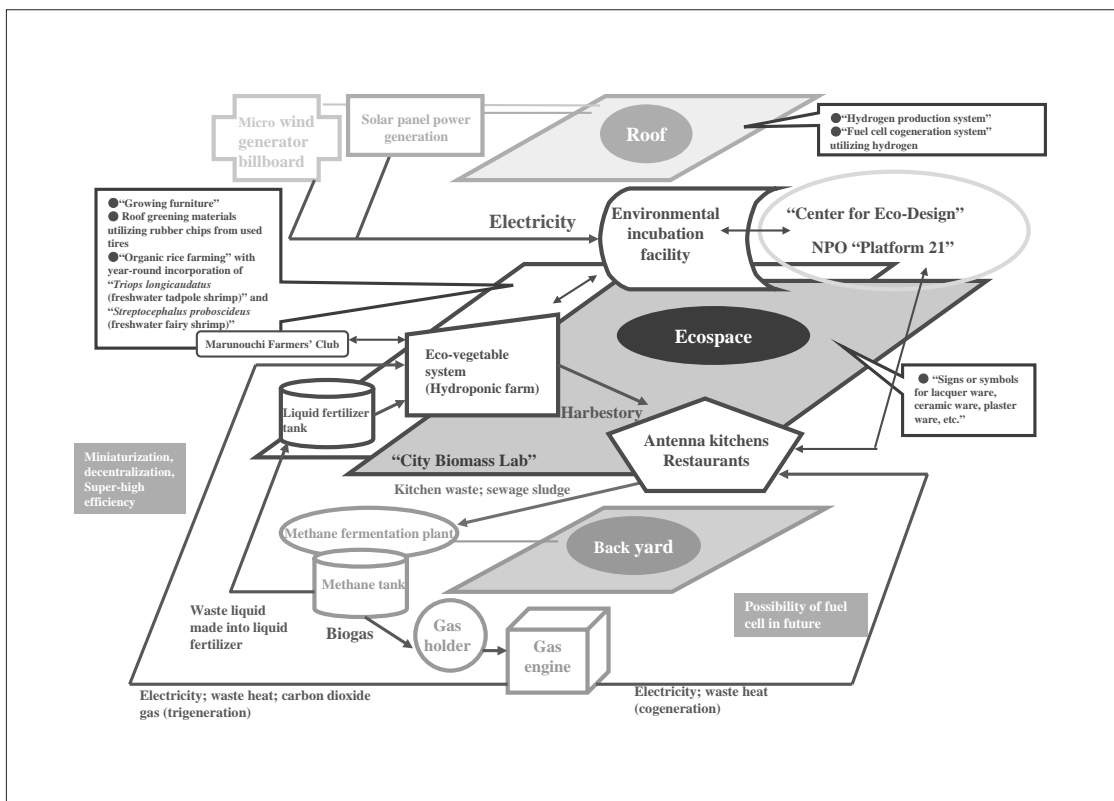
**Environmentally friendly**

Since they are made of natural materials, hinoki tatami mats are easy to dispose when renovating the building. Leave them out in the open, and they return to the soil. Incinerate them, and they generate no toxic substances such as dioxins. The tatami mats are created with the future of our natural environment in mind, and feature the uncompromising use of natural materials. The product was approved as an Eco-Mark Product in 1999.

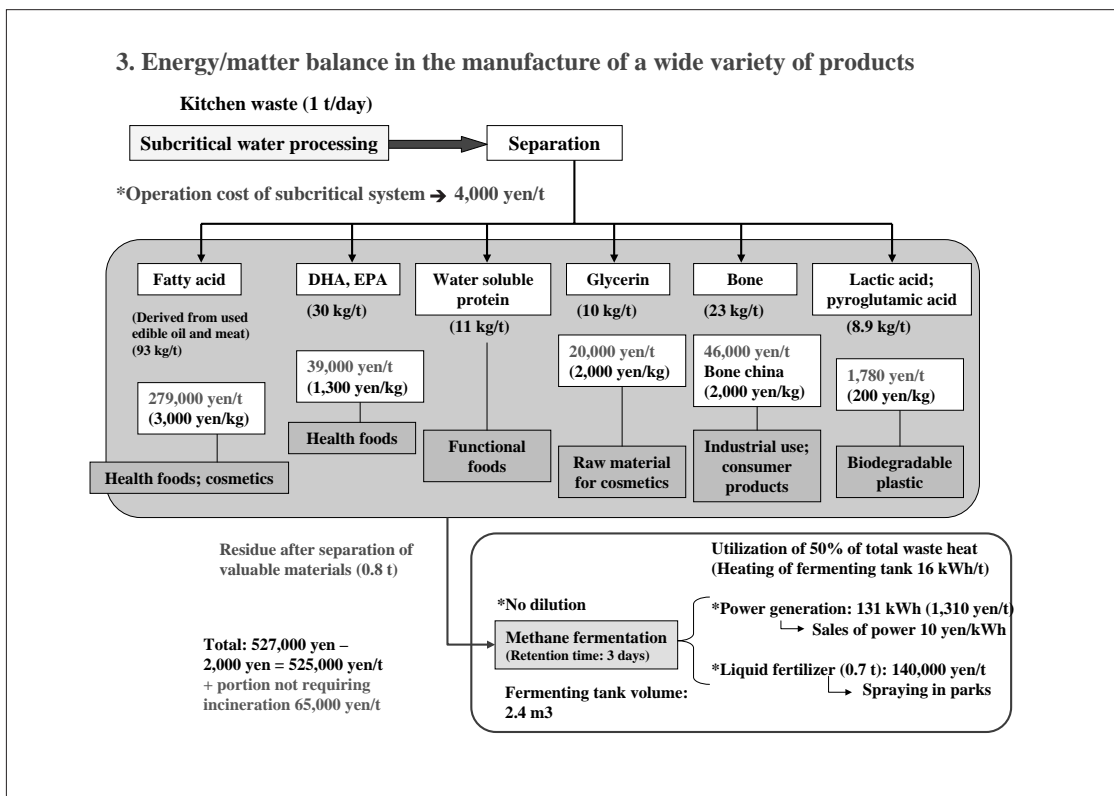
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Slide ⑤

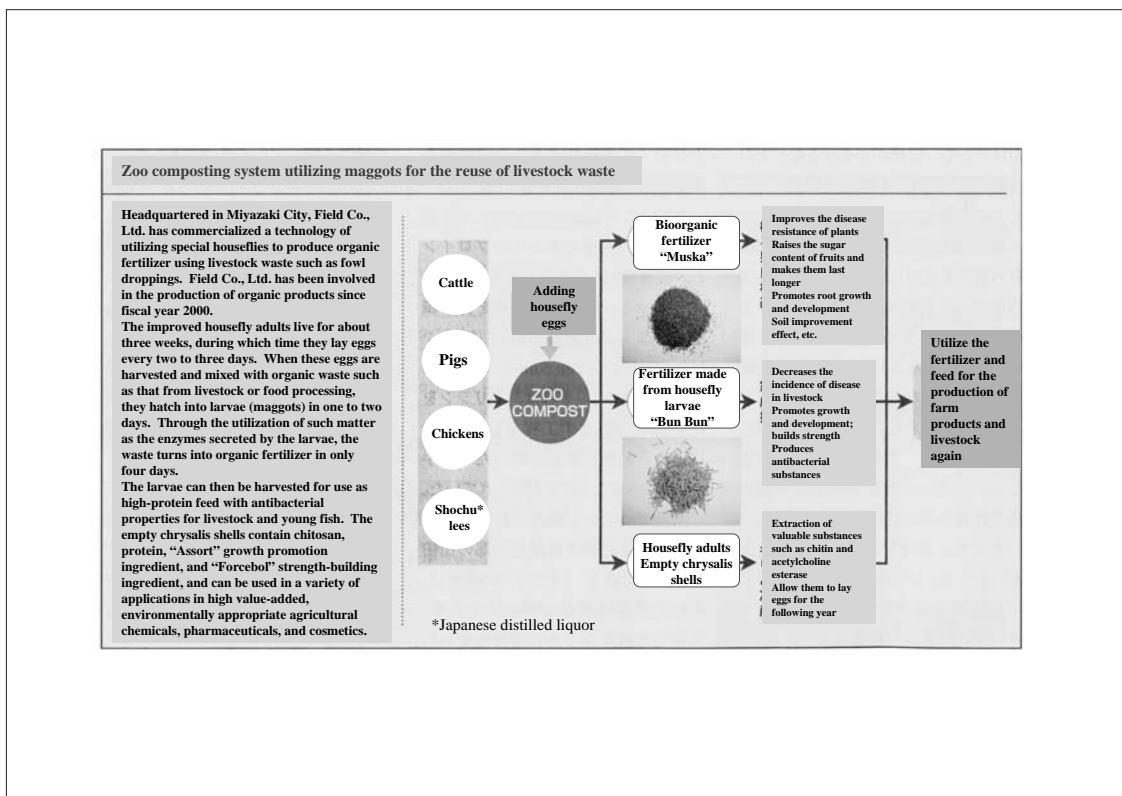


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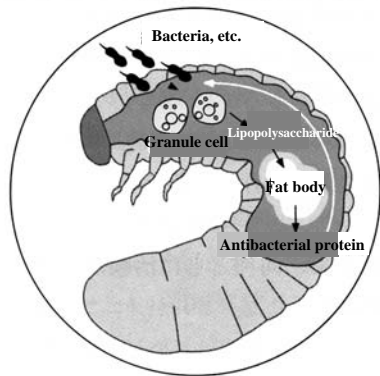


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