Special Feature

Sumitomo Forestry, Growing with Wood

Following the Great East Japan Earthquake, many people in Japan once again came to realize the importance of maintaining family bonds, living in a safe environment that provides peace of mind, and securing energy, and out of this realization a new sense of values and way of thinking about society is emerging.

As a professional in the fields of 'wood' and 'housing,' the goal of the Sumitomo Forestry Group is to continue to grow at the same time as being a leader for the age by considering the question of what direction society should move in and then providing proposals based on the answer.

Smart + Wood
Sumitomo Forestry's Smart Houses

Sumitomo Forestry is integrating its Smart House technologies with its wooden-home technologies that offer the latest environmental functions to create living environments that keep down electricity consumption and CO_2 emissions, thereby realizing economic benefits at the same time as reducing the impact on the environment.

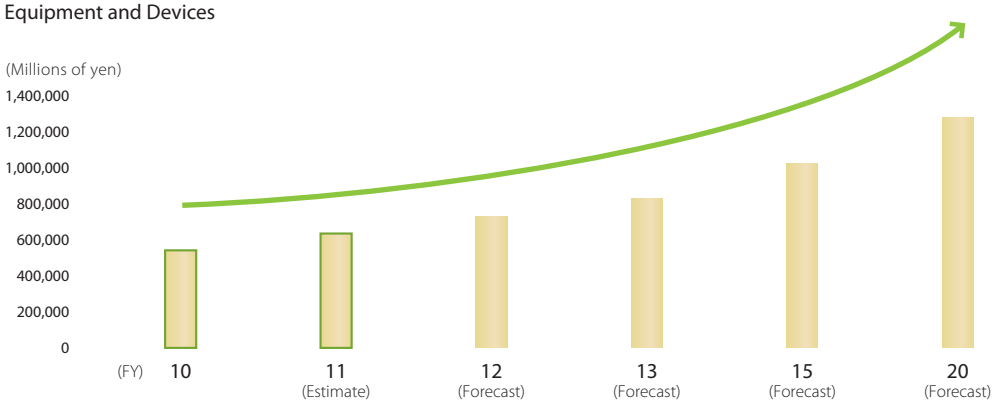
The Smart House market is expected to grow in the medium-to-long term

Following the Great East Japan Earthquake and the consequent concern about ability to maintain a stable supply of electricity, interest has grown in the smart house, which is able to effectively use energy and maintain a pleasant living environment while also being considerate to the environment and efficiently using electricity. According to a recent survey*, the market for major systems for such homes is forecast to grow significantly in the next few years and to exceed 700 billion yen in fiscal 2012, and 1 trillion yen in fiscal 2015.

In a situation of fluctuating household electricity charges, from 2012 a subsidy scheme has been launched for the installation of home energy management systems (HEMS) and household power storage battery systems. Going forward, demand for products that enable energy to be used more efficiently is forecast to continuously increase.

* From "Results of a study into principal equipment and devices used in smart homes 2012," published by the Yano Economic Research Institute in May 2012

Market Scale Analysis and Forecast for Principal Smart House-related Equipment and Devices



* The survey targeted the eight main smart house-related equipment categories of the home energy management system (HEMS), smart meters, solar power systems, fuel cell systems, gas engine cogeneration systems, small-scale wind power generation systems, household power storage battery systems, and V2H (Vehicle to Home) systems (all for household use). The installation costs are not included in the survey. (Source: Yano Economic Research Institute)

Smart House
In general, a smart house refers to a home that is installed with technologies such as a solar power system, household fuel cell system, and home-use household power storage batteries, and that uses a home energy management system (HEMS) to make visible the energy used by these devices within the home.

What is the Sumitomo Forestry's Smart House?

The Group's Smart House is a wooden structure, equipped with a wide range of environmentally sound systems to cater to diversified lifestyles. In addition to its heat insulation performance, surpassing 1999 energy conservation standards*1 and its use of *Ryouonbou* design concept that skillfully taps natural energy to achieve high levels of energy conservation, such as by calculating how air flows through the house, how sunlight enters it, and how trees in the garden are distributed, it features a wide range of optional environmentally sound systems tailored to different lifestyles, enabling more efficient use of energy.

Environmentally sound systems that can be installed in our Smart House include solar power systems, the *ENE FARM* household fuel cell system, and the home energy management system (HEMS), as well as 12 kWh- and 4.8 kWh-capacity household power storage batteries and the vehicle-to-home system (V2H)*2, a technology in which this division is a pioneer in the Japanese home construction industry. Systems such as these meet homebuyer preferences, and provide comfortable, economically and environmentally sound homes.

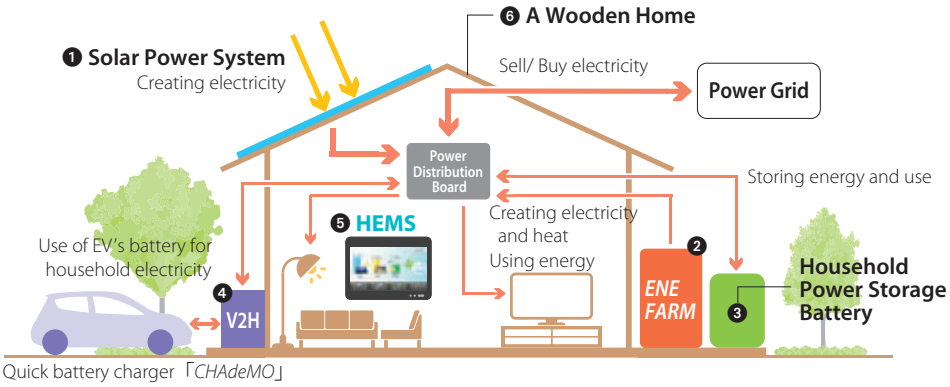
Compared with steel frame and RC frame homes, wooden housing emits less CO_2 from the material procurement to construction stages, and enables capture and storage of CO_2 as a raw material, contributing to global environment protection by curbing emissions of CO_2.

*1. The original standards were established in 1980, in combination with energy conservation legislation enacted in 1979. The latest standards were amended in 1999, and these are important benchmarks for energy-saving and heat insulation efficiency in home construction.
*2. The system enables use of an electric vehicle's large-capacity battery as a household power supply via the power distribution board.

Future developments

At the Sumitomo Forestry Group, we are responding to the needs of the time and working to increase sales of our safe and secure smart houses, at the same time as further developing and evolving our smart house technologies. In particular, we are pushing ahead with the development of lifecycle carbon minus (LCCM) homes by utilizing a basic feature of wood-constructed homes, which is that they emit a low volume of CO_2 emissions throughout their lives. LCCM homes achieve a negative carbon footprint over their lifecycle by offsetting the CO_2 generated during the construction, occupancy, and dismantling stages with forms of renewable energy used during occupancy. We are currently carrying out a testing program in a trial LCCM home and analyzing the data collected on energy usage. In addition to aiming to achieve the optimal performance of the devices linked to HEMS and control systems, in developing our proprietary Smart House technology our goal is to create LCCM homes that will contribute to the realization of a low-carbon society.

The Six Features of Sumitomo Forestry's Smart Houses



Being mainly made of wood, they have a small environmental footprint, and can incorporate a wide range of environmentally sound systems that can be adapted to meet residents' lifestyle requirements.

❶ Solar Power System

Solar panels generate electricity and unused electricity is sold to power companies. The panels are sophisticatedly designed in harmony with their surrounding environment.

❷ *ENE FARM* Household Fuel Cell System

CO_2 emission volumes can be curbed by using gas to generate power, and waste heat from power generation for heating water and rooms.

❸ Household Power Storage Battery System

Adopting high-capacity lithium-ion batteries, the system contributes to cutting peak electricity demand by using stored energy, and it can be utilized as an emergency power source during power cuts.

❹ Vehicle-to-Home System (V2H)

The system enables use of EV's storage battery as daily household power supplies, and as a reserve power supply in emergencies.

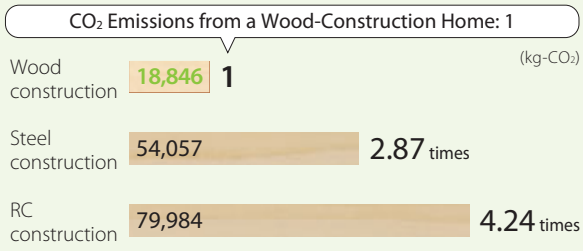
❺ Home Energy Management System

By monitoring the household usage of electricity from power grid, solar power system, power storage battery and other devices daily and in real time, it promotes saving and controlling of electricity consumption.

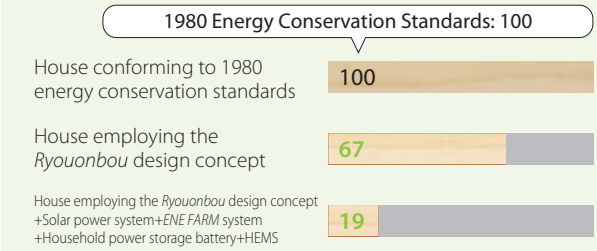
❻ Wooden Homes for Conserving Energy

Lifecycle emission of CO_2 associated with a wooden home is naturally at a low level. Insulation efficiency that surpasses the latest 1999 energy conservation standards, and our *Ryouonbou* design concept, which utilizes natural energy to reduce the use of heating and cooling equipment, can greatly reduce CO_2 emissions.

CO_2 Emissions per Home According to the Building Material Used *1



Comparison of Annual CO_2 Emissions*2



*1. CO_2 emissions per home (with a floor space of 136m²) refers to CO_2 emitted when the main construction materials are manufactured (Source: Okazaki *et al* (1988), Wood Industry No.53-3)
*2. Assumptions for calculations
- Comparison between a home conforming to the 1980 energy conservation standards (using both electricity and gas, hot-water system; ordinary gas water heater) and a home employing the Company's *Ryouonbou* design concept and using solar power system (4.00kW), *ENE FARM* system, household power storage battery (12kWh), and HEMS (using both electricity and gas). Heating and cooling systems employed are air conditioning units and underfloor heating in the living room. The home used for modeling purposes was a two-story home that belongs to region IV of the geo-climatic regional division of the energy conservation standard for heat insulation performance, with floor area of 130.83m², accommodating a family of four.
- CO_2 emissions per unit of electricity: 0.555kg-CO_2/kWh; CO_2 emissions per unit of gas (processed natural gas): 2.29kg-CO_2/m³.
- The home we used for modeling purposes was based on certain assumed conditions that may diverge from actual conditions due to differences in occupant lifestyles, weather conditions and the location of the building.

Smart Reforest

Currently, our smart house initiatives are mainly focused on new housing customers. But there is a growing sense of crisis in emergency power saving and supply from customers who are already resident in detached homes, and requests for the realization of smart house functions, such as energy creation, energy conservation and energy storage are increasing. To respond these demands, Sumitomo Forestry Home Tech Co., Ltd., our Group company of the renovation business, launched the *Smart Reforest*, a new renovation product that realizes smart house functions for existing homes, in April 2012.

In *Smart Reforest*, we utilize our proprietary renovation technologies for earthquake resistance, and heat insulation to create homes that are secure and comfortable. Firstly, we improve the basic performance of existing home, and then install the latest equipment for systems to generate, conserve, and store electricity. Our proposals are targeted to eliminate lighting and heating expenses. We utilize wood, which is a renewable natural resources, as the structural material for building foundation, and also as the interior material to create a pleasant living environment. We propose an optimized plan to each of our customer and renovate, so that they can live securely and comfortably for the indefinite future.

The Sumitomo Forestry Group's Proprietary Earthquake Resistance Renovation Technologies

Sumirin ARC
Construction Method
Enhances and secures the strength of an unreinforced concrete building foundation, the same as or stronger than a reinforced concrete building foundation, by using an epoxy resin adhesive to affix band steel and aramid fibers to the surface of the foundation.

Sumirin JEM
Construction Method
Combines and reinforces the building's posts and foundation by using epoxy resin adhesive to affix specially designed hardware to the surface of the existing foundation.

Glass Block Shear Wall
Simultaneously achieves structural strength and brightness of room space.

Portal Frame Shear Wall
Realizes an expansive space while also increasing strength.

Hope + **Wood**

Sumitomo Forestry's Social Contributions and Research & Development

We are pursuing new possibilities for wood in order that may contribute to people and society through our businesses.

Providing technology as well as hope in disaster areas

At the Sumitomo Forestry Group's Tsukuba Research Institute, we conduct broad-ranging R&D into using wood as a resource and material and into the housing sector in general and then return the results of this research back to society in the form of better homes. In this section, we introduce some of the wood-based social contribution activities that only we at the Sumitomo Forestry Group are capable of carrying out.

Takata-Matsubara was a place of scenic beauty that was said to boast 70,000 pine trees, but this forest was destroyed by the tsunami generated by the Great East Japan Earthquake so that only a single tree remained. This single pine tree became a symbol of hope not just for the residents of nearby Rikuzentakata City, but also to the many who had suffered due to this natural disaster and it came to be known as the "Pine Tree of Hope." However, this solitary surviving tree was in an extremely weakened state, having been submerged in sea water and having suffered damage to its trunk. In April 2011, we responded to a request for assistance from the residents of Rikuzentakata City and sent a team of specialists from the Tsukuba Research Institute and our subsidiary, Sumitomo Forestry Landscaping Co., Ltd., to team up with local landscape engineers, greening groups, universities and national research institutes to not only save the Pine Tree of Hope, but also to form a project team to create saplings toward reforesting the area.

The Pine Tree of Hope

Tsukuba Research Institute

Using the genetic material from the "Pine Tree of Hope" for saplings for the future

Analysis revealed that the Pine Tree of Hope's roots were rotten because they had been submerged for such a long period of time and it was regrettably determined that the damage was so severe that the tree could not be saved. However, the Sumitomo Forestry Group's technology was put to work to cultivate saplings from the Pine Tree of Hope. Our researchers came up with two promising methods to cultivate the saplings: a cloning and grafting technique using genetic material collected from the pine, and a technique for cultivating saplings from some of the Pine Tree of Hope's few surviving seeds.

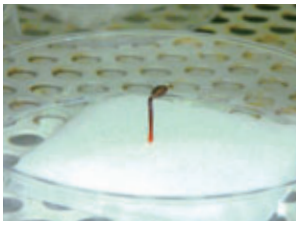
After continued trial and error, researchers were only able to succeed in using the cloning cultivation method after utilizing a grafting technique* and the resulting saplings are now growing healthily. For the second method, they were able to collect just 25 seeds from within the tree's few remaining pine cones to grow the saplings. Initially, only a few seeds were planted under experimental conditions, but none of them sprouted. The researchers then decided to use an artificial environment to encourage the seeds' sprouting and for the next six months the remaining seeds were planted in low-temperature conditions, and two weeks after they were transferred to a controlled growing environment they were able to confirm that the seeds had taken root and were sprouting. The researchers were ultimately able to grow 21 seedlings, 3 from the clone seeds using the grafting method and 18 from the pine tree's actual seeds.

Going forward, it is hoped that these saplings will be symbols of hope for Rikuzentakata City and play a part in its restoration. We will take special care of them as they grow and moreover we will cultivate many more saplings.

* Grafting is a cultivation method whereby tissue removed from one plant is inserted into the same or related species of plant.

A sample of the pine tree collected by researchers

Some of the collected pine cones



Growing one of the few remaining seeds in temperature-controlled conditions

We succeeded in creating saplings from the Pine Tree of Hope's genetic material; the seeds sprouted and are growing healthily

Tsukuba Research Institute

The Tsukuba Research Institute has also focused on the three fields of "resources," "materials," and "housing," as it seeks out the possibilities of wood as a material. It has been conducting R&D into wood as a material for constructing attractive homes, for effectively utilizing resources, for creating pleasant living environments, and for a host of other research themes toward achieving the ultimate goal of contributing to the creation of a recycling-oriented society

In the fields of "resources" and "materials," researchers have focused on trees, an environmentally sound sustainable natural resource, and the potential of wood as a material. They continue to carry out research into afforestation technologies in Japan and overseas, landscaping technologies, and new applications for wooden boarding using leftover plantation timber, as well as new uses for wood generally.

In the "housing" field, the institute is conducting broad ranging research into new types of wooden homes and more comfortable living environments. This includes not only into the key functions of homes but also R&D that ranges from proposals for housing that can effectively use natural energy and that can be changed in response to their life stage through to the psychological effects that living in wooden homes has on the emotions of their occupants.

R&D Activities at the Tsukuba Research Institute

The Resources Field

The cultivation of heritage and precious trees through biotechnology techniques (cherry blossoms of *Togyu no Sakura*, at Daigo-ji Temple in Kyoto)

Materials

A facility for the test manufacture of wooden boards

MIZDAS high-temperature timber drying system

Housing

Earthquake-resistance testing

Experimental environmentally symbiotic house

The Sumitomo Forestry Group's technological capabilities

The scope of the research and technological development focusing on wood at the Sumitomo Forestry Group is extremely broad. One recent and important example of this is our development of the Big-Frame (BF) construction method. Up to the present time, housing in Japan followed a repeated scrap and rebuild cycle, with a home having to be rebuilt every 20 to 25 years. But we decided to leave behind this concept and after approximately four years of intensive R&D and testing, we have launched a housing product that is a high quality asset in which the occupants can live indefinitely.

The BF construction method, the only such method in Japan, uses wooden beams supported by a Rahmen structure, creating a strong building frame by linking big columns to beams. As a result, there is no need for shear walls and it creates an open living space while also allowing for greater freedom at the home planning stage and the possibility to change the layout in the future.

In addition, the Sumitomo Forestry Group is not only evolving the construction of wooden homes in Japan–including by developing pre-cutting technologies for housing building materials, constructing systems for CAD and CAM, and launching engineered wood materials–it is also providing wood-construction homes using the Group's proprietary building methods that in turn utilize its cutting-edge technologies. Going forward, we will continue with R&D that will expand the possibilities of wood.

Structural framework of Big-Frame construction method

Pre-cut housing building materials