Special Feature

The Evolving *Sumitomo Forestry Home* Houses

Aiming to create safe homes with low environmental impact that maximize the qualities of wood

Since the Great East Japan Earthquake, there has been growing interest in the safety of homes due to concerns over damage caused by the disaster in Japan. Also, energy efficiency has become a public issue following power shortages after the nuclear accident, with Japan's energy future now a common topic of discussion. In this feature section, we look in more detail at the safety and durability of *Sumitomo Forestry Home* houses and our environmental performance such as energy efficiency. We also reveal some of the initiatives we are taking to develop new types of housing for the future.

01 The safety of *Sumitomo Forestry Home* houses

Utilizing three construction methods to achieve high levels of safety, we build wood-frame homes based on proven technology and provide support to ensure our customers enjoy safe and comfortable living environments for many years.

Home development underpinned by an intimate knowledge of wood

On an equal-weight basis, Japanese cedar has roughly four times the tensile strength of steel*1 and around six times the compressive strength of concrete*2. Japanese cypress, meanwhile, has extremely good durability, lasting for roughly 2,000 years after harvesting. These examples illustrate the excellent performance of wood as a construction material. Also, logs of a certain thickness that catch fire form a carbonized layer on the surface that delays the spread of flames to the center of the wood. All our custom-built wooden houses, which combine these characteristics of wood with our unique technologies, achieve the highest level of earthquake resistance and long-term durability based on the Japanese Housing Performance Indication System.

*1. The maximum stress textiles, steel or other materials can withstand without tearing or rupturing while being stretched in one direction.
*2. The maximum compressive load a material can withstand.

Multi-Balance construction method: Combining traditional techniques with cutting-edge technology

Our proprietary Multi-Balance construction method is an evolution of the traditional Japanese wooden post-and-beam construction method that has a proven track record in many of our homes, including our mainstay *MyForest* range. The traditional post-and-beam frame construction method is enhanced with our original load-bearing wall materials such as *Kizure Panels, D-Panels,* and *Tough Panels*, resulting in an extremely robust structure that can safely withstand repeated shocks from major earthquakes or typhoons. A key feature of this construction method is the use of laminated engineered wood such as *Super Cypress*, which is roughly 1.2 times stronger than ordinary natural wood, while the *Earthquake Energy-Absorbing Panels (GS Panels)* used in the structure are highly resistant to earthquake shocks, reducing building deformation during major earthquakes by up to approximately 70%*. These panels are fitted as standard to our custom-built detached houses *MyForest [GS]* and can also be added as an option to other homes built with the Multi-Balance construction method depending on construction conditions. A growing number of our customers are choosing to add these panels to their new home plans.

*Compared with the ordinary diagonal strut construction method.

***MyForest [GS]* (built with the Multi-Balance construction method)**
A custom-built detached house fitted with *Earthquake Energy-Absorbing Panels (GS Panels)* as standard that are highly resistant to earthquakes. The panels further enhance the earthquake resistance of the Multi-Balance construction method.

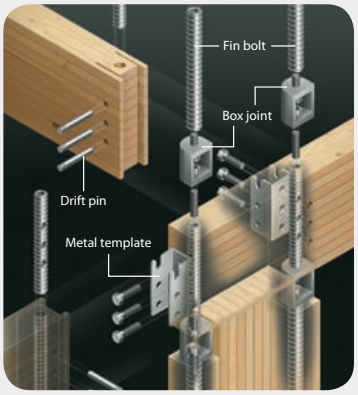
Earthquake Energy-Absorbing Panels (GS Panels)
Our panels convert earthquake tremors into heat to significantly reduce damage to the building. They do not tend to degrade over time and maintain their earthquake resistance for a long period.

Big-Frame construction method: Excellent earthquake resistance and high degree of planning freedom popular with customers

The Big-Frame construction method is based on a building frame with reinforced joints linking the columns and the beams, supported by a Rahmen structure that precludes the need for durable facings*. The end result is a construction method for wooden houses that is unique to Sumitomo Forestry. Big columns, with five times greater width than columns in typical construction methods, are connected to the beams with reinforced metal components, resulting in high earthquake resistance without the need for durable facings and creating an extremely robust overall structure. The method creates open living spaces, allowing greater freedom at the home planning stage and offering more possibilities to change the layout in the future. In order to encourage wider uptake in the market for Big-Frame housing products, we are actively working to boost visibility and reduce costs to drive sales higher.

*Walls capable of withstanding horizontal loads from earthquakes and strong winds.

***BF-Si* (Big-Frame construction method)**
An extremely safe structure that also realizes open living spaces.



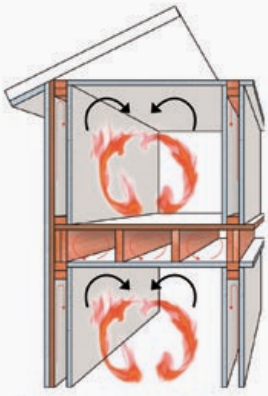
The large columns and the beams which directly convey strength are connected by originally developed Big-Frame joints comprised of all-metal parts (fin bolt, box joint and template). This results in a highly rigid, robust wooden structural framework with very little rattle or compressive strain.

Two-by-Four construction method: Realizing multi-story construction in fire prevention zones

The two-by-four construction method uses a six-sided box monocoque structure*, giving the building high earthquake resistance that prevents distortion and deformation. The rear sides of walls and the roof, which tend to become a path for flames during a fire, are made using a fire prevention structure. The homes are also designed as firebreaks, are resistant to heat from fires in neighboring buildings and employ exterior wall structures that are resistant to damage. The resulting package is a building with advanced, multiple fire resistance features. The two-by-four construction method was given approval as Japan's first fire-resistant wooden frame in 2004. This enabled the construction of wooden buildings in certain sizes and regions and for certain purposes that had previously been forbidden. Our first four-story housing product, the *EARLYbird-For*, employs wood in the design to create warm and extremely safe living spaces, giving customers the option to also create spacious family living environments in urban areas where building codes are particularly strict. These products also meet the need for houses with adjoining rental apartments or shops.

*A construction method that uses the walls, floor and ceilings as an integrated whole to support the structural load.

Exterior view of the *EARLYbird-For*, our wood-construction four-story fire-resistant housing
Highly resistant to fire and earthquakes, this product's four-story construction enables the efficient use of small plots in urban areas and has enough space for two families to live in comfort.



Fire stop structure
A structure designed to confine fires to single floors or rooms, making it difficult for the fire to spread to the rest of the building.

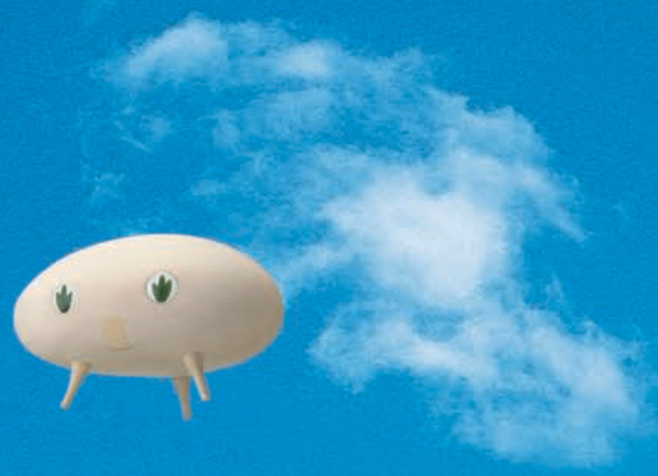
Extensive guarantee and support system

Sumitomo Forestry provides extensive long-term and regular backup to customers to ensure their houses remain safe places to live. We guarantee the structure and water resistance of our homes for 20 years, 10 years longer than required by law. For homes that have been approved as excellent long-term housing by the government and local authorities, we provide a guarantee system of up to 30 years. Customers can also call a phone helpline 24 hours a day, 365 days a year and we have a regular maintenance system and program in place that can be used for up to 60 years for the life of the home.

02 Energy efficient and environmental features

Our homes are based on energy efficient design technology that harnesses the power of nature. They also come fitted with equipment that reduces energy consumption and CO_2 emissions, giving our homes extremely advanced environmental performance.

Moreover, we take steps unique to Sumitomo Forestry in our planting efforts that offset CO_2 emissions during the construction phase.



Ryouonbou: Using the power of nature to achieve energy efficiency

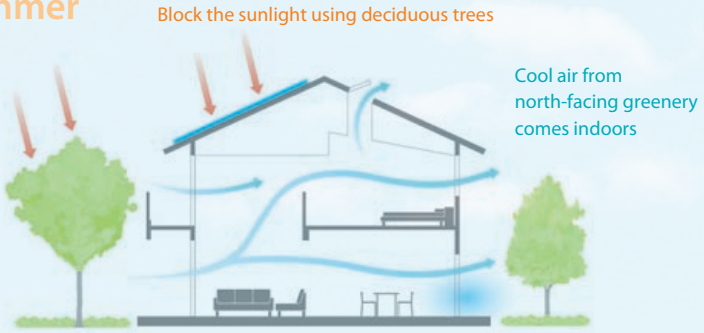
Energy used in the home is mostly for heating and cooling. We have adopted some of the knowledge and innovations from traditional Japanese homes that can adapt to changes in the weather to create our *Ryouonbou* design process, which is aimed at improving the energy efficiency of homes. *Sumitomo Forestry Home* houses comfortably exceed the insulation and hermetic performance defined in next-generation energy conservation standards*, which equate to the highest level of heating performance in the Japanese Housing Performance Indication System. Leveraging these characteristics, we design floor plans that draw the breeze and sunlight into the home and plant shrubs in optimum locations to create comfortable living spaces that do not rely too much on heating or cooling systems.

*Japan's energy conservation standards were created in 1980 to reduce energy consumption in homes. Since then, these standards have been revised and strengthened, with new energy conservation standards introduced in 1992 followed by next-generation energy conservation standards in 1999. *Sumitomo Forestry Home* houses achieve the highest level (4) in the next-generation energy conservation standards.

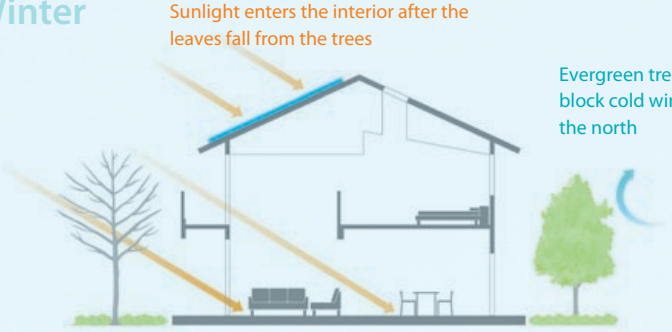
The *Ryouonbou* design concept

In summer, our homes are cooled by blocking sunlight and by creating paths for the breeze to carry away heat. In winter, we maximize the rays of the sun and prevent heat from dissipating to keep the home warm.

Summer



Winter



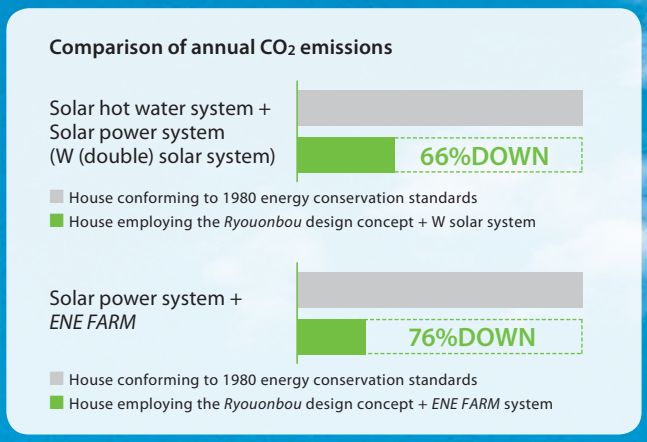
Using solar power and fuel cell units to promote energy efficiency

We strongly promote energy saving through our houses. The *Solabo*, our eco-housing product, features environmental equipment as standard and introduces the *Ryouonbou* design concept, boosting its environmental performance. We are also promoting energy efficiency by increasing the ratio of environmental equipment fitted in our other housing products.

We estimate that one of our homes with a solar power system and hot-water heating system that efficiently uses solar energy to heat the water generates up to around 66% less CO_2 emissions over the course of a year than a normal home. This figure rises to a maximum of roughly 76% when an *ENE FARM* household fuel cell is also installed. The *ENE FARM* fuel cell generates electricity from a chemical reaction between hydrogen extracted from gas and oxygen in the air.

Environmental housing product *Solabo*, which generates its own energy

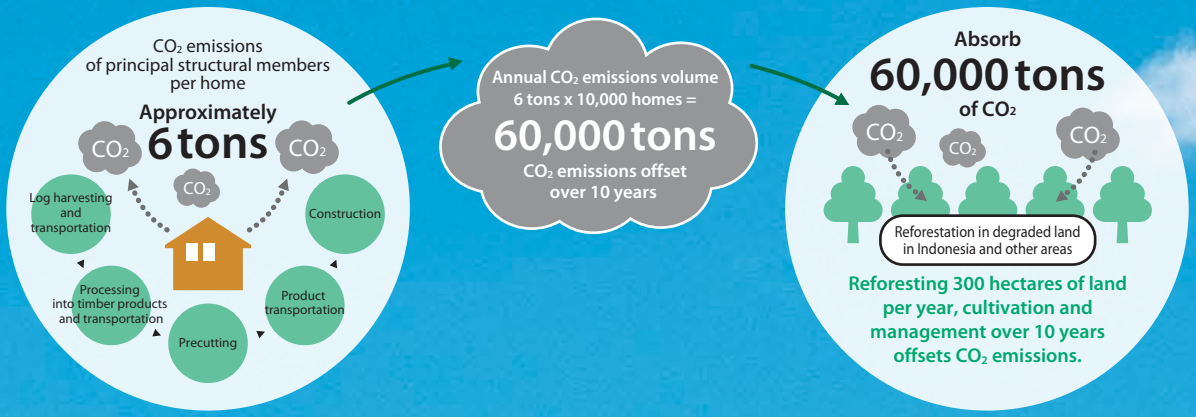
*Assumptions for calculations:
- Comparison between a home (using both electricity and gas, hot-water system; ordinary gas water heater) built based on the 1980 energy conservation standards, a Sumitomo Forestry home based on a *Ryouonbou* design concept with a solar power system (3.84kW) and a variety of environmental equipment and gas appliances (electricity and gas dual use). Heating and cooling systems employed are air conditioning units and under floor 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.



Wooden houses that stock CO_2; carbon offset initiatives

Compared with steel or concrete houses, wood houses generate less CO_2 emissions during the construction phase. Typical wooden houses* also stock a carbon volume equivalent to the amount stocked by a forest covering 3.5 tennis courts (around 900m²). We actively use domestically produced wood for principal structural members and promote the use of our forests in Japan as CO_2 absorbs. We also replant trees in degraded forests in Indonesia and other areas equivalent to twice the floor area of each house we build, offsetting CO_2 related to principal structural members during the construction phase. In these ways, we are working to contribute to the environment even as we build houses for our customers.

*Assuming carbon volume of around 6 tons stocked into wood used to build a home with a total area of 136m².



03 Developing new types of housing for the future

We are aiming to help prevent global warming by ensuring the most efficient supply-demand energy balance possible for the whole of society. Specifically, our goal is to create *Sumitomo Forestry Home* houses that conserve, generate, store and visualize energy, and push forward with the development of technology compatible with smart grids*.

Aiming to create life cycle carbon minus homes

Sumitomo Forestry is conducting research and development on lifecycle carbon minus (LCCM) homes. LCCM homes achieve a negative carbon footprint over their lifecycle by offsetting the CO_2 generated during the construction, occupancy and dismantling stages with solar power and heating and other forms of renewable energy during occupancy.

Developing technologies that conserve, generate, store and visualize energy is vital to making LCCM homes a reality. Specifically, we are enhancing insulation efficiency and using highly efficient equipment to boost the energy efficiency of our homes, using solar power generation systems and household fuel cells, and installing electricity storage batteries for when power is not needed. We also need to create a home energy management system (HEMS) that optimally manages overall energy supply and consumption within the home and that also communicates those conditions to the occupants.

At the APEC conference held in Yokohama in November 2010, we participated in the Yokohama Smart City Project demonstration, revealing our LCCM concept model for the first time. The concept model featured an electric vehicle high-capacity Lithium-ion battery as the home's power storage battery, which could be recycled into batteries in the future under a project we also outlined. We also explained the progress we are making with HEMS. In addition, we are currently carrying out a testing program, including the construction of a trial home to monitor the performance of an installed household power storage system.

The role of homes in society is undergoing a significant change. Based on our overriding goal of supplying homes that are comfortable and that people can live in with peace of mind, we will continue to do our part to realize a sustainable society by driving the continued evolution of *Sumitomo Forestry Home* houses so that they are energy efficient and help prevent global warming.

*Smart grids:
Next-generation power grids that utilize IT to constantly optimize power supply and demand. The goal with smart grids is to develop highly efficient, high-quality, and extremely reliable power supply systems by controlling distributed power sources such as existing hydro and thermal power generation facilities and new energy sources such as wind and solar power.

Conceptual diagram of a home with an EV lithium-ion battery as the power storage battery