



BUILDINGS FOR ALL SEASONS

A power shovel is used to transport snow to the snow room in the Okudaisen Bunanomori Water Plant in Kofu-cho, Tottori Prefecture.

In regions with heavy snowfalls, the cost to homes and businesses of snow removal and snow melting is high, and energy consumption for heating in winter continues to increase. However, technologies for reducing energy consumption that utilize the cold and snow as energy sources are beginning to come into widespread use. Masaki Yamada and the *Japan Journal's* Osamu Sawaji report.

ENERGY FROM SNOW

In snowy regions, snow removal is a major challenge. The cost of snow removal and the securing of places where the removed snow can be dumped are a big headache for local communities. Hope is at hand in the shape of technologies that use this snow as a source of energy.

The most popular method is to store snow that has fallen during the winter, and ice made from the cold outside air, and to utilize that cold air and cold water for crop storage and air-conditioning right through until summer. For example, a storage facility for brown rice in Bibai City in central Hokkaido stores 6,000 tons of brown rice using 3,600 tons of snow.

The temperature inside the storehouse is maintained at 5°C, preventing deterioration of flavor. At New Chitose Airport, the aerial gateway to Hokkaido, snow is stored on a corner site 100 m long by 200 m wide. The snow melt that flows from this snow storage facility, said to be the largest in the world, is used for air conditioning of the airport building in summer. This provides 20–30 per cent of the energy used in the building as a whole.

Leading beverage manufacturer Suntory has installed a snow room to store snow at its Okudaisen Bunanomori Water Plant (site area about 290,000 square meters) in Kofu-cho, Tottori Prefecture, com-

The Okudaisen plant is open to members of the public by appointment, and receives more than 8,000 visitors each year.

the water itself is totally unpolluted, draining artificially heated water into a river that has a lower water temperature may have an impact on the environment.

At the same time, however, the company was able to dramatically curb the consumption of fuel required to transport the



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pleted in 2008. The characteristic of the plant is that its production line utilizes snow.

The Okudaisen plant is situated at the foot of Mount Daisen (1,729 m), the highest peak in the Chugoku region of southwest Japan, and produces mineral water using water pumped from within the site. Densely wooded with a vast forest of Japanese beech, this is one of the heaviest snowfall areas in the Chugoku region, with 1–2 meters of snow accumulating in winter.

The snow room of the Okudaisen plant is able to store up to about 250 tons of snow. In this region, snow begins to fall in earnest from around December. The snow that accumulates within the site is collected using a power shovel and transported to the snow room. By January, the snow room is normally full of snow.

In winter, water from the melted snow in the snow room is used to make cold water, which is then employed to cool the mineral water production facility. The production facility generates heat, which increases the temperature of the water used to cool it. When this occurs, it is passed through a pipe in the center of the snow room, where the temperature of the water is lowered before being discharged into the river. The reason for this is that, while

snow, since it takes around 30 tons of snow from the snow room per day to cool this heated water. In January 2011, around 500 tons of snow, enough to fill 200 dump trucks, were melted without being transported off-site.

In summer on the other hand, the snow in the snow room is used as cold water for air conditioning inside the plant. The inside of the snow room is well insulated, so the snow that has been stored in winter is still there by the time summer comes.

With the use of this snow room reducing the electricity required for air conditioning and cooling, the Okudaisen plant has succeeded in curbing carbon dioxide (CO₂) emissions by around 5 tons per year.



The mineral water production line at Okudaisen Bunanomori Water Plant. The snow from the snow room is used to cool the heat generated by the production line

THE WEATHER-PROOF HOME

With the demand for eco-friendly goods in recent years, people in Japan are taking far more interest in the creation of electric power using natural energy in ordinary homes, and in energy saving products such as low power consumption air conditioning, heating, and household electrical appliances.

As far as the use of natural energy in ordinary homes is concerned, the use of solar power generation systems in particular is becoming increasingly widespread with the support of national and local governments. According to a survey by the Japan Photovoltaic Energy Association, as of April 2012 the total number of residential solar power generation systems installed in Japan has passed the one million mark.

However, the disadvantage of the solar power generation system is that power generation is affected by the weather. On rainy or cloudy days, reduced power generation is unavoidable.

In this context, leading manufacturer of residential homes PanaHome developed homes that use geothermal power, a stable natural energy that is not affected by the weather.

“We came up with the Comprehensive Home So-

lution that wraps the entire house in insulation, from ceiling to external walls to the foundations, utilizing the natural heat of the earth. The basis of that concept is to see the space under the floorboards as a space that utilizes geothermal heat,” says Seishi Shiote, chief manager of the House Planning and Product Development Department of PanaHome. “Instead of cutting off the space under the floorboards from the living space by attaching insulation materials to the under side of the floorboards as is the case with regular homes, it takes in geothermal heat directly.”

In this case, the geothermal heat is different from that which hails from the interior of the earth, such as magma; the sort which is used in the generation of electric power. Geothermal heat used in the Comprehensive Home Solution is heat that is heated (or cooled) by sunlight and air and stored in the earth. This ground source heat is not easily influenced by changes in temperature caused by the seasons or weather conditions, and the heat from approximately 10 meters below the ground is maintained at around the annual average temperature (in Tokyo, around 16°C.)

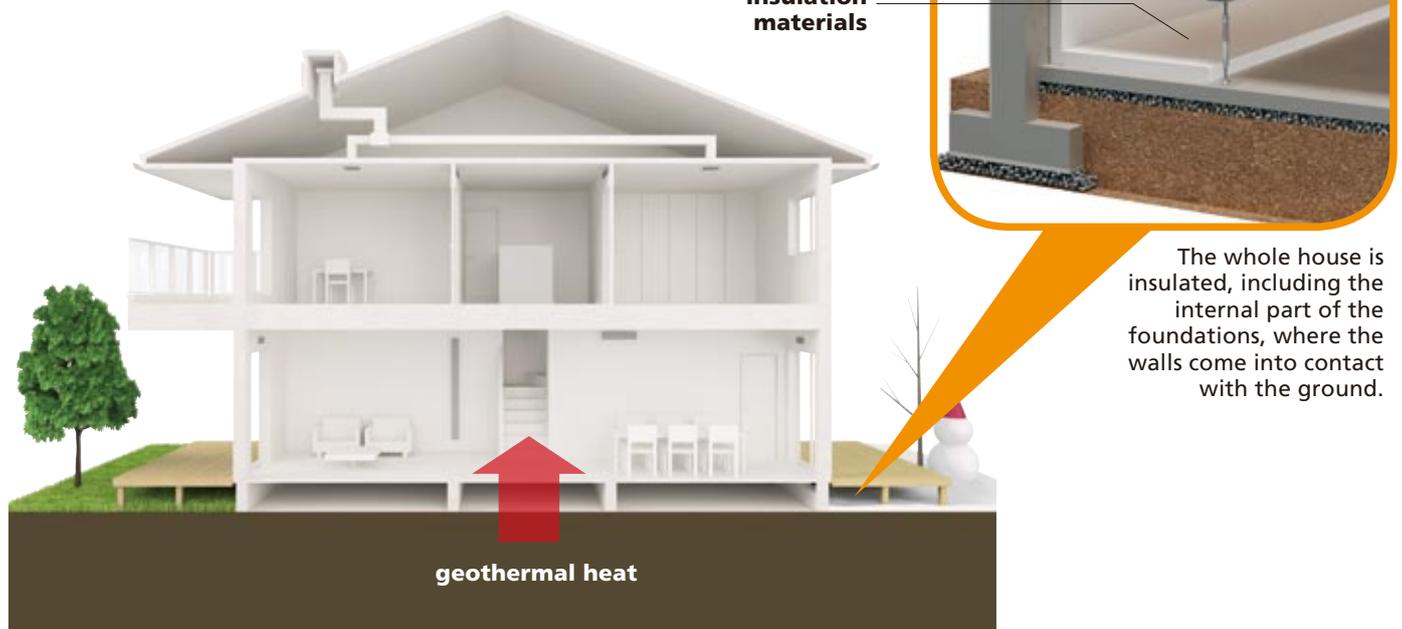
In the past, insulation materials had been attached

Publicity image of a CASART TERRA home



ALL PHOTOS COURTESY OF PANAHOME

The award-winning Comprehensive Home Solution system is designed to take in geothermal heat directly.



to the under side of the floorboards of residential homes. However, with the Comprehensive Home Solution insulation materials are placed in the internal part of the reinforced concrete foundations rather than being attached to the under side of the floorboards. The space under the floorboards is not completely airtight, since air vents are placed on the foundation in order to take in air from the outside to this space. However, even so, the effect of geothermal heat means that there is less variation in the temperature of the air under the floorboards compared with the air outside, so that it is cool in summer and warm in winter.

The ECO NAVI Ventilation System exploits that air under the floorboards. With this system, sensors measure the difference in temperature between the inside and the outside of the home and automatically control the amount of ventilation depending on the temperature difference. In winter, air heated under the floorboards is automatically taken into the room. In summer, when the room temperature rises, cold air from under the floorboards is brought into the room using a fan. While this is simply ventilation rather than air conditioning or heating, this system reduces the energy for cooling and heating.

In this way, it is possible to realize energy savings using natural energy without installing large-scale equipment. When a comparison is made using the same criteria between a household of an assumed four family members (total floor area 123 m²) and the CASART TERRA home that has introduced the Comprehensive Home Solution and ECO NAVI Ventilation System, the yearly heating and lighting expenses for the CASART TERRA is around a quarter of the yearly heating and lighting expenses for a regular home. Further, the annual volume of CO₂ emissions can be reduced from 3.55 t to 1.40 t. Residents living in CASART TERRA homes say how happy they are to be able to live in such a large house and not have to worry about their electric bill, while at the same time being able to help the environment without being aware of it.

The Comprehensive Home Solution and the ECO NAVI Ventilation System are without parallel in the world and their outstanding energy-saving features are regarded very highly, receiving the Minister's Prize from the Ministry of Land, Infrastructure, Transport and Tourism in the 9th Eco-Products Awards (Eco-Products Category) in Japan in 2012.



Indispensable Items *for* Protection against the Cold

In Japan, there are many handy products to keep one feeling warm and comfortable when the temperature drops. The following items are popular with all age groups, and for many are considered indispensable in the winter months.

Disposable Body Warmers



A standard sized disposable hand warmer

When the cold becomes severe and the hands and feet are freezing, the time has come to get out the *kairo*!

Kairo, or disposable body warmers, owe their warming effect to the heat generated when iron powder oxidizes. Just remove the pouch from its vinyl packaging, shake it gently and it will heat up right away. Commercialized in Japan in the late 1970s, kairo are made from nonwoven fabric and are filled with iron powder, salt and activated carbon. Sizes vary, but the commonly used pouch is small enough to fit into the palm of the hand and will maintain a pleasant heat when opened for about twenty

hours. The heat in the smaller pouches lasts about half as long.

Many people use kairo habitually as a simple and portable product for staying warm when working outside in winter, or commuting to school or work. In addition to the regular and mini size pouches, there are kairo that attach to clothing or inserted into shoes. According to the Japan Disposable Body Warmer Manufacturers Association, more than 2 billion kairo were sold in Japan between May 2011 and April 2012.

These handy disposable body warmers are also becoming popular overseas where they are used in ways that suit the circumstances in each country or region. Kobayashi Pharmaceutical Co., for example, sells disposable body warmers in twenty countries and regions around the world including China, Hong Kong, Japan, Taiwan, the United Kingdom and United States. According to the company, the most common usage in North America, for



Disposable body warmers sold by Kobayashi Pharmaceutical Co. These products are sold in China (left), Japan (center) and the United States (right).

