

[S7 Renewable Energy]

# ***Smart House and Office Building Technology***

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## **1. Introduction**

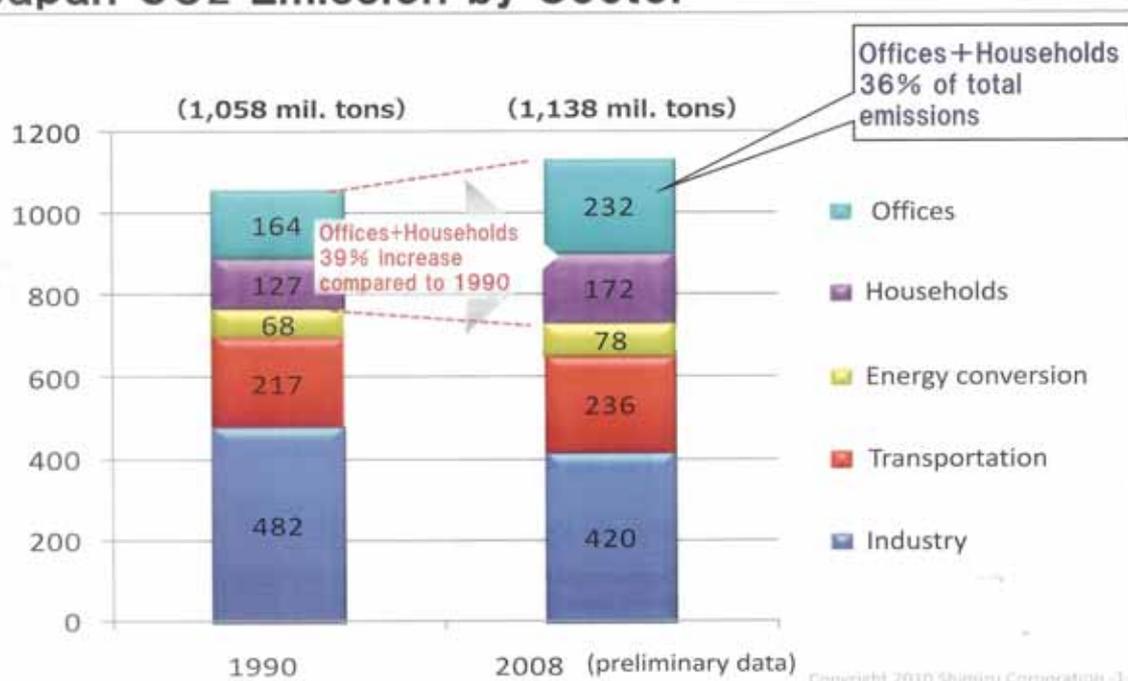
Japan, as a country poor in natural resources, had suffered from critical oil crisis twice, and had faced various environmental problems such as atmospheric and water pollution during the process of rapid economic development in the past. Those experiences brought intensive investment and technological development to increase energy efficiency. Coincided with rapid economic growth and urbanization, urban infrastructure was provided in urgent need, such as road, railway, water supply, sewerage and housing. Through the experience as a front runner to overcome urbanization and environmental issues synchronically, Japan accumulated advanced environmental technologies and management expertise to improve attractiveness and quality of life of urban area. With these technologies and expertise, Japan is currently challenging to the new agenda; climate change, global warming and sustainability.

Understanding that global warming is one of the most important universal issues, which requires urgent and collective efforts of the global community, Japan set a target of reducing greenhouse gas emission (GHG) of 25% by 2020, if compared to the 1990 level, which is premised on the establishment of a fair and effective international framework in which all major economies participate and on agreement on their ambitious targets. It is estimated that more than half of GHG comes from activities in urban area, such as office and commercial buildings, households and transportation. Urban planning owes large responsibility of reducing GHG emission.

In order to achieve this goal, Japan is stepping forward steadily to materialize low-carbon society, which pursues energy efficiency and sustainability, through environmental technologies and expertise under close collaboration of public-private-academia. We are proud of our good practices of optimizing demand and supply of energy by integrating energy system into city development plan, and introducing renewable energy. Japanese sewage treatment plant is designed

to produce recyclable resources through the process of purification, such as digested gas for public transportation and gray water. Green planting on rooftop and wall of buildings are effective to lower the temperature in urban area. Current urban planning policy supports prevalence of such good practices and focuses on development of “compact city” which concentrates urban facilities into central area and improves accessibility by public transportation network, understanding that such a city with compact structure will contribute to establish low-carbon society.

## Japan CO<sub>2</sub> Emission by Sector



In 2008, Japan launched “EMC (Eco Model City) Project” as the action for the low carbon society in which the government selects the cities to challenge the ambitious target of GHG emissions reduction and encourage them to achieve the target. 13 cities are nominated as EMCs. EMCs determined to become the advanced leaders and share their experiences among Japanese communities for achieving the goal of GHG reduction, co-working with the central government, private sectors, and most importantly with citizens.

Economic growth in Asian and Pan Pacific region is driving development of urbanization. In the process of transition to low-carbon society, we need to take full responsibility for environmental consideration of our activities, and to employ environmental technologies for encouraging green growth. Japan, with its experience and technological expertise of constructing and managing eco-friendly

city, has been cooperating to create sustainable cities in many countries and areas. It is our sincere message that we are determined to continue our efforts to contribute to green growth in our global community by sharing Japanese experience and technological expertise of creating eco-friendly city.

## **2. Promotion of urban scale effort**

Japan enacted Energy Management Law in 1951 and started to introduce the better energy management. The law enforced factory managers to prevent energy loss as much as possible and to exert the maximum effort to recycle the energy. Since then, Japan paid so much attention to save energy and the energy consumption in manufacturing sector is decreasing now. On the other hand, the energy consumption in business, livelihood and transport sectors are increasing. Then the government recommends factories 6 fields of effort such as efficient burning system, efficient heating and cooling facilities, waste heat recovery system, self or co-generation system, thermal insulation and less impedance system, and less energy equipments of lighting, elevator and etc. Farther more, factory managers should submit annual report of energy consumption and the 3 to 5 year plan to improve energy efficiency.

According to the data of the energy consumption in Japan by sectors in 1990 and 2008, manufacturing sector decreased by 12% but other sectors have increased such as transportation 9%, households 35%, offices 41% and energy conversion 14%. The share of office and household is 36%, transportation 21% and manufacturing 37%. Therefore, the save energy effort in office, household and transportation is the keen problem.

Former Prime Minister Hatoyama's proclamation in UN in 2009 that Japan will reduce the carbon emission by 25% by the year of 2020 maybe achieved if we can decrease by half in office and household and 10 to 20% in transportation and manufacturing. Transportation sector is now doing two big efforts to reduce carbon emission. One is the introduction of hybrid engine or electric automobile and another is the promotion of public transportation. Manufacturing sector may continue their effort and realize the less carbon emission production system. The problem would be office and household sector. There are some proposals from private sector on the matter. They are aiming 50% cut of CO<sub>2</sub> emission in near future and total cut in the long future.

### 3. Smart house technology

Japanese government introduced Top-runner System in 1999 and Eco-point system in 2009 in order to promote the introduction of less carbon devices. Top-runner system means that in the every automobile and electrical home appliance manufacturer should aim such high efficiency in energy consumption as the top level that the government recognizes. If not, the name of the manufacturers will be public announced or given the penalty. Eco-point system means that the purchasers will be given the eco-points if they purchase governmentally recommended electrical home appliances or reform their houses into eco-house. The points are equivalent as the gift voucher.

One Japanese leading company in electric appliance, proposes "Eco Idea House" that can cut 53% of energy consumption in a house at present, 65% in near future, and 100% in long future by means of the better usage of ground

heat and sunshine with the equipment of improved electric appliances.

For example, wind passage tower system will send warm ventilation in winter and cool in summer.

The introduction of tilted-drum washer/dryer attached with heat pump system can save water and carbon emission.

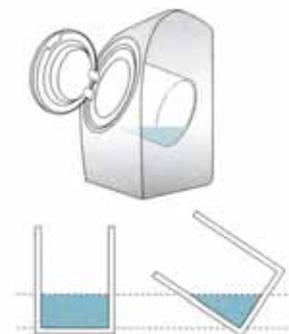
Cleaning air throughout the house with the natural blessing.

This is a hybrid air-conditioning system combining natural and mechanical ventilation. The Wind Passage Tower S installed in a living room takes in cool air in summer and warm air in winter beneath a floor to realize effective energy-saving ventilation.



Reducing water bill and CO2 emissions in washing everyday

This washer/dryer washes and dries with less water. An amount of water used for washing is radically reduced by tilting a washing tub. The ecological washer/dryer that dries clothes rapidly using the heat pump technology consequently cuts electricity costs.



Heat pump technology can utilize the natural heat in the air and save energy greatly. Saving energy with thermal insulation technology is also important.



**Using energy generated from heat in the air**  
An energy conservation technology that gathers, transfers and utilizes heat scattered in the air is adopted in refrigerators, air conditioners, washers/dryers and hot water supplies. It reduces power consumption and saves lighting and heating expenses.



Fuel cells generate electricity in a home using city gas (hydrogen) and air (oxygen). It also boils water with heat generated at the same time as electricity and uses this hot water for showers and floor heating systems.

The vacuum insulation panel now have broader applications, from home appliances such as refrigerators and jar pots, to residential equipment such as bath units, and building materials. U-Vacua, the vacuum insulation panel developed by Panasonic, greatly contributes to energy-saving with improved insulation performance.



Household power generation system and storing electricity technology have been also developed.



By adopting lithium-ion batteries capable of accumulating a large amount of energy in a small body, the system realizes a compact body and high performance. It allows optimization of the power use inside a house, backing up the fuel cells and solar power generator. (exhibiting for reference)

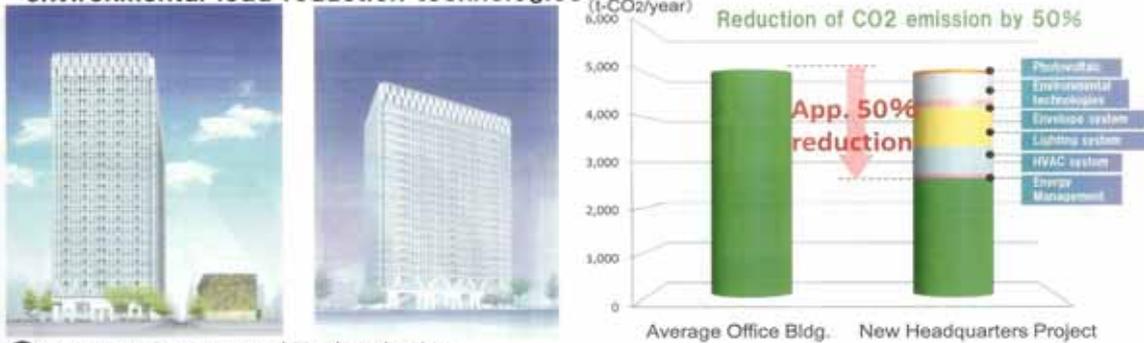


#### **4. Smart office technology**

One construction corporation is now building the main office in downtown Tokyo. This building aims to save 50% energy consumption by means of present technologies such as solar electric generation, sunlight utilization, LED lighting and hybrid panel. Future target is to save 75% by means of photovoltaic, large volume storage cell, micro grid, biomass, geothermal and etc.

This headquarter project aims to cut 50% of CO2 emission as follows.

● Half Carbon Office that makes the full use of leading edge environmental load reduction technologies



● Main Environmental Technologies

Advanced energy saving technologies -35%

- Envelope system app. -200 tons CO2/year (-4%)
- Lighting system app. -850 tons CO2/year (-17%)
- Air-conditioning system app. -600 tons CO2/year (-12%)
- Energy Management app. -100 tons CO2/year (-2%)

Conventional energy saving technologies -15%

- Air-conditioning VAV-Outdoor Air Cooling -60 tons CO2/year
- Rooftop Greening-Wall Greening -7 tons CO2/year
- LED lighting -45 tons CO2/year
- Water reuse-Water conservation -25 tons CO2/year
- Ventilation VAV -10 tons CO2/year
- High efficiency transformers -35 tons CO2/year
- VWV-Large temperature difference air-conditioning -75 tons CO2/year

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And this corporation proposes further technologies as follows.

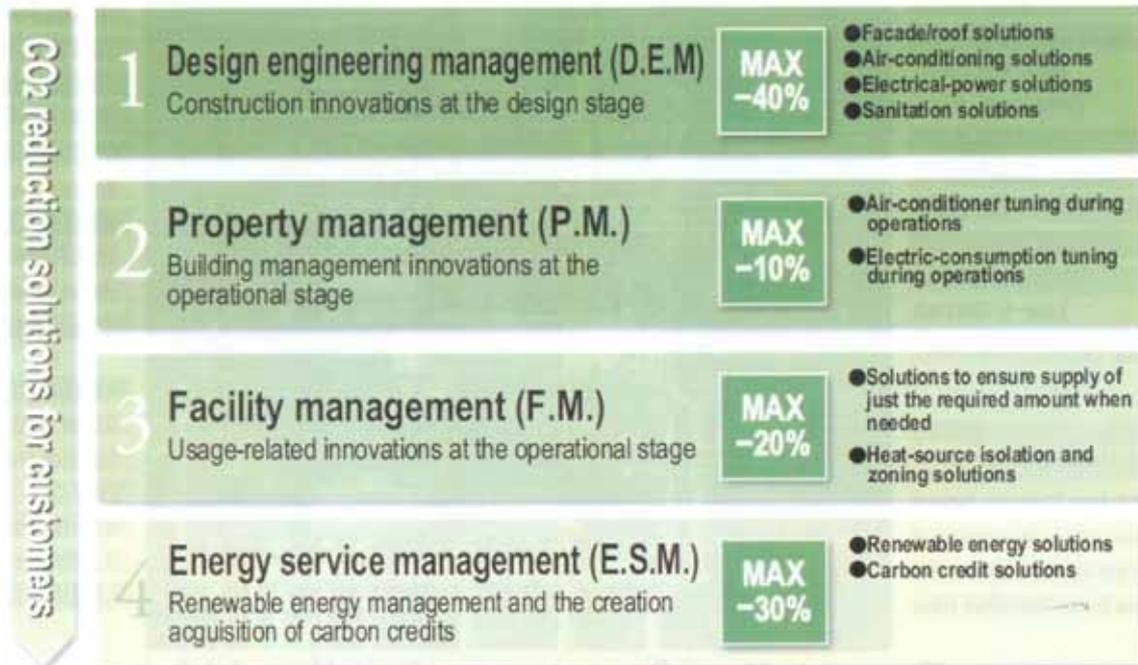
Line-up of Energy Conservation Technologies : Eco-Buil-Pack 50

Energy Saving (Architecture)	Energy Saving (M&E)	Natural & Renewable Energy Use
<ul style="list-style-type: none"> <li>PV Cell, Solar Heating</li> <li>Wind Power</li> <li>PV Cell on Building Element</li> <li>Roof Insulation</li> <li>"Gradation" Blind</li> <li>Light Shelf</li> <li>Daylighting</li> <li>Top Light</li> <li>Natural Ventilation</li> <li>Hybrid Ventilation</li> <li>Low-E Glazing</li> <li>Dry Mist</li> </ul>	<ul style="list-style-type: none"> <li>BECCS</li> <li>Large Temperature Difference Air-conditioning</li> <li>Closed-loop Concrete System</li> <li>Adaptation of Energy-efficient Equipment</li> <li>Energy-efficient Equipment Operation</li> <li>Grasping Energy Conservation Status</li> </ul>	<ul style="list-style-type: none"> <li>"Tronax" Thermal Energy Storage System</li> <li>"Direct Pure Ice" System</li> <li>Ice Transportation for cooling</li> <li>Rooftop Garden</li> <li>Green Wall</li> <li>Outdoor Air Intake Control</li> <li>Building Thermal Mass Storage</li> <li>Night Purge</li> <li>Task &amp; Ambient HVAC System</li> <li>Human Sensing Lighting System</li> <li>Outdoor Air Cooling</li> <li>Rainwater Use System</li> <li>Water Reuse System</li> <li>Co-generation System</li> <li>Fuel Cell</li> <li>NaS Battery</li> <li>Ice/Water Storage</li> <li>Cool Pit</li> </ul>

For existing & new construction bldgs.

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Final carbon management will become as follows according to this corporation.



It is also important to improve the pavement. Water retention material absorbs and retains water in the pores of the asphalt mixture in the pavement and this pavement technology can reduce the surface temperature.

## 5. Conclusion and acknowledgement

As mentioned above, it is not impossible to save carbon emission as Japan submitted to the Secretariat of the United Nations Framework Convention on Climate Change. But as the total emission of Japan is not so large if we compare with those of USA and China, it is highly expected to keep the world cooperation on this matter. I would like to repeat the message from the Government of Japan, which is stated in the New Growth Strategy, that Japan is ready to cooperate with Asian countries to create low-carbon society.

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