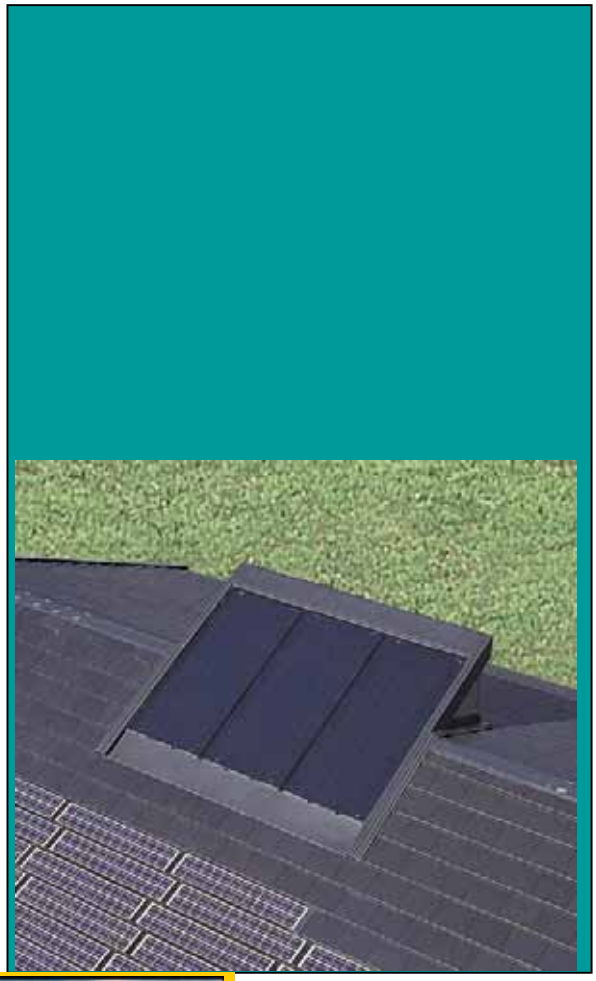


KankyoKobo,

Sunny Eco-House

International Energy Agency

IEA – SCH Task 28 / ECBCS Annex 38:

Sustainable Solar Housing

Floor plans (Total floor area:150.35m^2)

The project "Kankyo Kobo"
-Single family house with two stories
-Date of completion: April 1st 2000
-Total floor area: 117.90–167.47m^2
-Private built house and Ready-built house
-Number of houses sold:
(Apr 2000 through Sep 2002)

Objectives

"Protect the environment" is now vital to every human being on Earth. Daiwa House, as a housing company, proposes a solution to the matter.

Improving energy efficiency, utilizing natural energy, and making the most use of natural resources was our policy when we developed our Eco-house, Kankyo Kobo.

1. Improving energy efficiency

Kankyo Kobo, with highly efficient performance for insulation and air tightness, satisfies the Japanese Housing Energy Efficiency Standards established by the Ministry of Land, Infrastructure and Transport, so-called "Next Generation Standards" in force since April 2002.

It has potential to reduce the CO_2 emission by 58.6% compared to the houses built in accordance with the Housing Loan Corporation standards, one of the requirements for the loan.

2. Utilizing the natural energy.

To utilize natural energy effectively, Kankyo Kobo is equipped with solar cell and solar collector.

3. Making the most use of natural resources

The water reclaim system is adopted to reduce the use of clean water. The reclaimed graywater is used for toilet flushing and garden sprinklers.

The kitchen unit is designed to facilitate the classification and storage of the recyclable items.

Although ecology conscious housing is usually expensive, we developed this prefabricated house, Kankyo Kobo, and realized and affordably priced Eco-house.

In addition, a drastic reduction of volatile organic compounds (VOCs) has been achieved. With its barrier free design, Kankyo Kobo supports the health and a comfortable life.

Building construction

Industrialized house

Kankyo Kobo is a prefabricated house, a structure with a high and stable quality formed with steel frames and proof stress panels. All the panel frames, exterior wall materials, heat insulating materials, and window sash frames are preset in the factory.

Painting exterior walls is also carried out in the factory in order to avoid the possible air pollution to the surroundings.

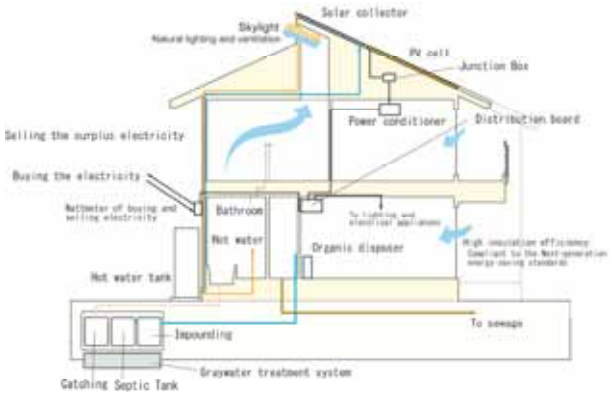
The air tightness is improved by binding panels with highly efficient bolts and by patching sheets and taping scrupulously.

Light gauge steel is used for the frames, ceramics for the exterior walls, highly efficient glass wool for heat insulating materials.

In cold districts, a greater amount of insulating materials are utilized to improve the efficacy.

Longer eaves prevent the fierce sunlight of summer and reduce the energy for air-conditioning. The rays of sunlight in winter can shine into the rooms and heighten the effectiveness of heating.

Kankyo Kobo satisfies "the Next Generation Standards" in every district of Japan.



System and material spec

		Districts IV & V		District III		District II	
		Material/System	K-Value	Material/System	K-Value	Material/System	K-Value
Roof/Ceiling		Blow-forming cellulosic fiber(25kg type), t=160	0.24	Blow-forming cellulosic fiber(25kg type, t=160)	0.24	Blow-forming cellulosic fiber(25kg type, t=200)	0.19
Exterior walls	General	High efficiency glass wall (16kg type), t=72	0.59	High efficiency glass wall (16kg type), t=100	0.45	High efficiency glass wall (16kg type), t=100	0.45
	Between floors	Hard polyurethane foam t=20	1.00	Hard polyurethane foam t=20	0.88	Hard polyurethane foam t=20	0.88
Flooring	General	Polystyrene foam sheet (B3),t=62	0.51	Polystyrene foam sheet (B3),t=62	0.51	Polystyrene foam sheet (B3),t=62	0.51
						Hard polyurethane foam t=80	0.34
	Tatami	Polystyrene foam sheet (B3),t=45	0.52	Polystyrene foam sheet (B3),t=45	0.52	Polystyrene foam sheet (B3),t=45	0.52
						Hard polyurethane foam t=80	0.30
	Unit bath	Hard polyurethane foam t=10	1.46	Hard polyurethane foam t=10	1.46	Hard polyurethane foam t=10	1.46
Aperture	Window	High adiathermic air-tight sash	2.91	High adiathermic air-tight sash	2.91	Resin sash	2.33
		High adiathermic double-glazing glass (A12)		High adiathermic double-glazing glass (A12)		High adiathermic double-glazing glass (A12)	
	Front hall door	adiabatic door	2.33	adiabatic door	2.33	adiabatic door	2.33
	Back door	adiabatic door	2.91	adiabatic door	2.91	adiabatic door	2.33
Ventilating system		New-VAC system		New-VAC system		PAC system	
Heating system		Connecting sleeves & outlet for air conditioner in each room		Connecting sleeves & outlet for air conditioner in each room		Central hot water heating	
Air tight works		Patching sheets, taping & etc.		Patching sheets, taping & etc.		Patching sheets, taping, airtight outlet & etc.	
Insulation efficiency (Q-value)		2.37		2.21		Polystyrene foam sheet: 1.74	
heat loss coefficient: W/m2K						Hard polyurethane foam: 1.68	
(Next Generation Standards)		(2.70)		(2.40)		(1.90)	
Insolation shielding efficiency (μ)		0.07 and below		0.07 and below		0.08 and below	
(Next Generation Standards)		(0.07 and below)		(0.07 and below)		(0.08 and below)	
Air tightness efficiency: C-value cm2/m2		5.00		5.00		2.00	
(Next Generation Standards)		(5.00 and below)		(5.00 and below)		(2.00 and below)	

Disctrict II: Cold districts, District III: Coldish districts, Districts IV & V: Temperate districts

Technical systems

-Ventilation

Variable Air Control (VAC) System:

Standard model (III IV V on the list above)

Ecology conscious ventilation system with the convergence control. Inspiration grill which opens and shuts censoring the atmospheric temperature change adjusts the air intake.

Photocatalytic Air Cleaning (PAC) System:

Cold district model (II)

In cold districts, PAC is introduced. It heats the outside air up to the indoor temperature before intaking. The system holds down the heat loss.

Common device

Motor operated air-cleaning louver is installed in the monitor roof.

-Energy saving devices

Window glass

There are the three types of glass, heat-sealed high adiathermic double glazing glass, high adiathermic double glazing glass and double glazing glass. The one best suited to the climate of the location and the direction of the windows will be chosen.

Window sash

Resin framed sashes for the cold district (II), and High adiathermic sashes for the other districts (III, IV, V)

Doors Adiabatic doors

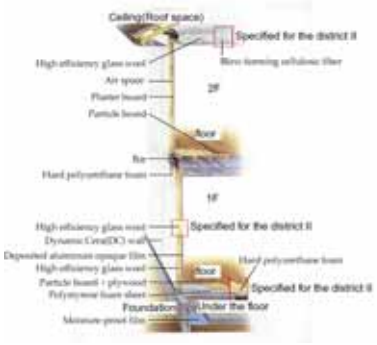
High adiathermic doors (k=2.33)

Lighting apparatus

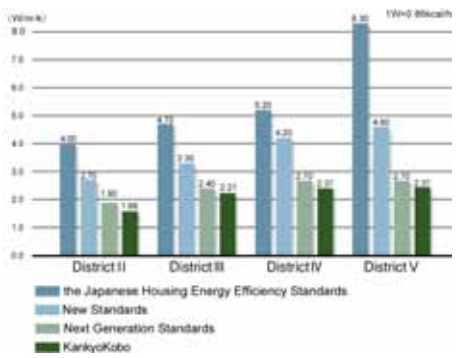
Inverter lighting is used in corridors to reduce the electricity.

Automatic lighting system is introduced on the porch. The light is switched on by a censor that perceives a human approaching.

Energy saving performance



Insulating material



Comparison of heat loss coefficient

Energy performances

- Solar energy generation

PV cells are a hybrid type of monocrystal and amorphous. Conversion efficiency is favorable of 17.3%, and decrease of power generation by heat is suppressed. Loading capacity is 3.00kw. Exterior appearance is designed to go well with the plain roof tiles.

At night, when the solar power cannot be obtained, electricity is bought from the power company. Surplus energy can be sold to the company.

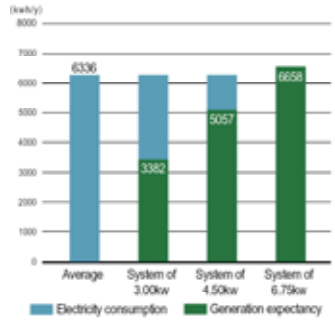
With the system of 3.00kw, annual production of electricity is estimated at 3,382kw. At the same time, the average electricity consumption of a general household is 6,336kw a year. 53% of consumption will be generated domestically. (Simulation model: Average family of 4, Total floor space of 150 m^2, in Osaka)

An indoor monitor shows the power generation to raise the residents' awareness.

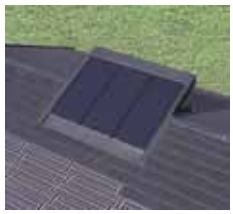
-Solar collector

Hot water from the solar collector with controlled circulation system is potable and can be supplied to 3 to 4 feeders, contrary to the natural circulation system.

Solar utilization reduces the annual consumption of gas by 54%.



Annual average electric power consumption and generation expectancy



Solar collector and hot water supply

Recycling of graywater

Recycling facilities

-Recycling of graywater

Rainfall and discharged water from the bath tub are decontaminated and utilized for toilet flushing and water spray for plants in the garden or for car washing. This recycling of water can reduce the use of clean water by 200 liters per day.

Costs

¥ 25,220,000 (150.35 m^2)
¥ 167,700 /m^2

Without solar system
¥ 21,268,000 (150.35 m^2)
¥ 141,400 /m^2

Marketing strategy

Kankyo Kobo is not an idealized prototype of a solar house, but an industrialized house with an affordable price. It supports the residents' healthy and comfortable eco-life with solar energy utilization, graywater recycling, and garbage recycling and with the devices to make life easier.

Housing with energy saving efficiency or a solar system can be the object of an extra-loan from the Housing Loan Corporation. In addition, the New Energy Foundation supplies the subsidy to the energy generated by solar power, ¥100,000 per kw with the limit of 10kw (April 2002 through March 2003).

These advantages are a part of our marketing strategy.

Other information

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