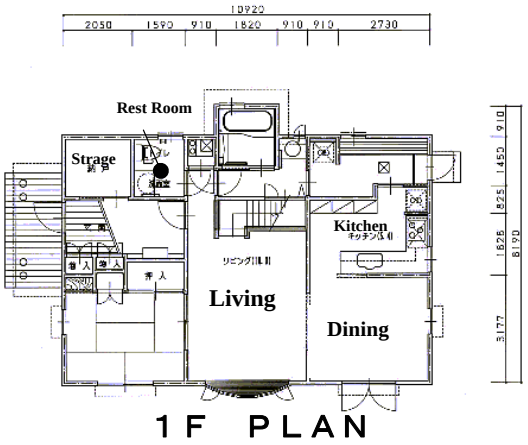
A low energy house with
(1)all heat exchange type central air conditioning ventilation systems,
(2)passive solar,
(3)the photovoltaic system.

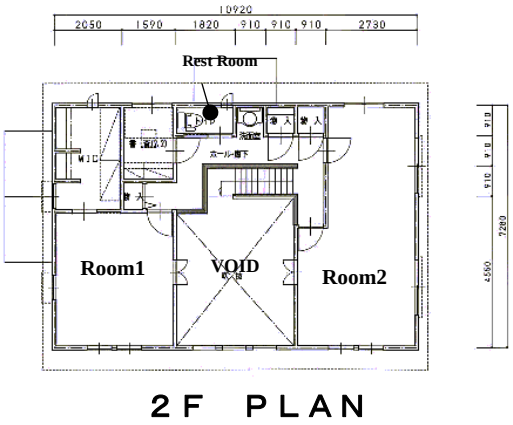
Kyoto, Japan

International Energy Agency

IEA – SCH Task 28 / ECBCS Annex 38:
Sustainable Solar Housing



1 F PLAN



2 F PLAN

South side elevation

West side elevation

The project

This residence is built in Kyoto. Kyoto is an area where it becomes 35 degrees C of maximum temperature in a summer, and thelowest temperature becomes 0 degree C in winter. It is a residential section and is the site where there is no high building in the circumference, and on the south and the west sides serve as a road. In order to employ the condition efficiently effectively, "the passive solar system of a direct gain system" is adopted.

The number of these residences is two and the floor of living and a dining room is a thermal storage floor. the upper part of living serves as a big well Since the large opening is taken in the well upper part, solar heat can fully be taken in to the back of living in winter. Moreover, as for the second floor portion, the device to which the first floor portion does not put in direct solar heat indoors in a summer by planting of the yard is given by eaves. And reflection of the solar heat to the first floor is suppressed by planting many plants in the yard on the south. About the western opening, the influence of the solar heat from the west side of a summer is suppressed by making a opening small as much as possible.

Objectives - Goals

By consuming much energy, our old life has acquired convenience. However, the increasing energy consumption has given the serious damage to earth environment. We are asked selecting the compact life style, which does not apply load to environment. It is using energy for it without futility and maintaining convenience with the least possible energy. The residence introduced here is the example which adopted all heat exchange type central air conditioning ventilation systems, passive solar, and the photovoltaic system, and just mitigated the damage to earth environment.

Building construction

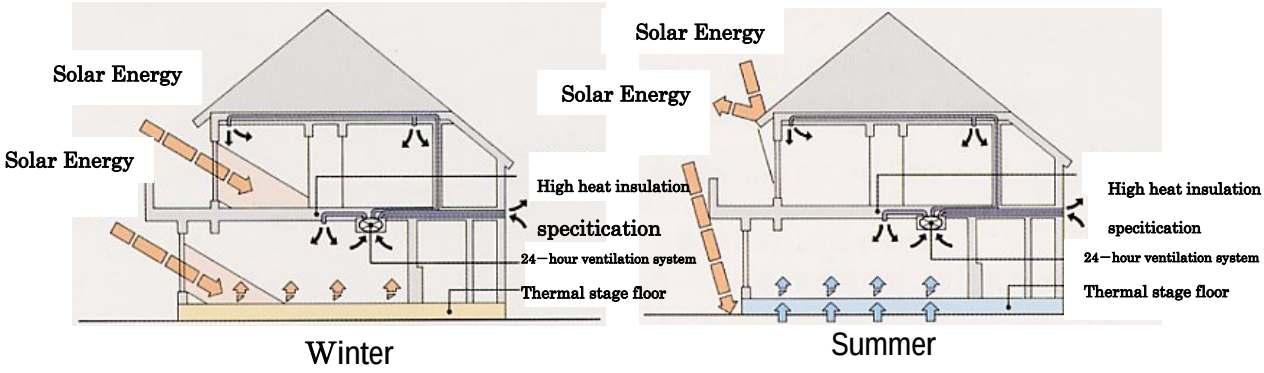
This residence is two-by-four structure. Two-by-four structure is the method of construction which was excellent in heat insulation nature and air-tightness from the first.

However,the heat insulation performance is raised as follows.

In order to acquire the thermal storage effect of solar heat effectively, heat insulation and the airtight performance of a residence are becoming important. In the heat loss coefficient [Q value] of this residence, 1.6W/ m^2K and the equivalent leakage area [C value] serve as $3cm^2/m^2$.

Heat insulation Performance

Heat insulation part	Thermal insulation	Thickness	[K value]
Ceilling	Rock wool	180mm	0.23[W/m²·K]
Out wall	Rock wool	90mm	0.50[W/m²·K]
Floor	Polystyrene form (the bead mothod)	90mm	0.44[W/m²·K]
Thermal strage floor	Polystyrene form (the pushing-out mothod)	50mm	0.45[W/m²·K]
Opening	Aluminum sash (double-glazed glass)	—	3.49[W/m²·K]



Technical systems

In winter, a passive solar system accumulates the solar heat which goes indoors at daytime in the thermal storage floor of concrete. A thermal storage floor heats a floor with the heat slowly at night. Work like a natural floor heater is carried out. Conversely, in a summer, direct solar heat is made for eaves not to enter indoors.

An indoor temperature rise is suppressed by doing so. There are few energy losses and they fill the inside of a residence with adopting all heat exchange type central air conditioning ventilation systems with clean air. In this residence, since it is considering as the system of air conditioning one apparatus, comfortable nature with few differences of temperature in a residence has been realized. Moreover, photovoltaic system 4.53kW is installed in this residence. That is, the solar blessing will have been acquired from passivity and active both sides. This residence is an all electrification residence which adopted the electric induction heater and the electric warm water machine, and provides all energies electrically.

Energy performance

(1)Winter temperature measurement result

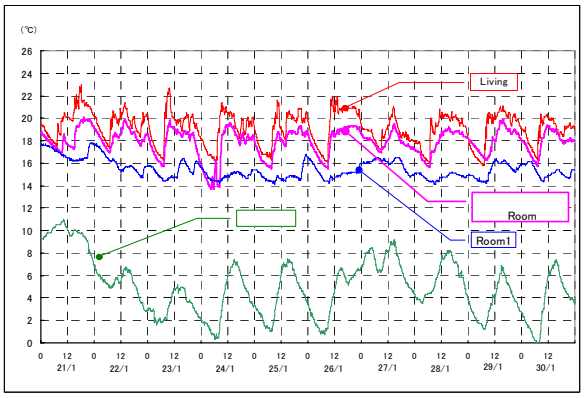
The living into which, as for winter, solar heat goes is over 20 degrees C daytime. There is no necessity of heating most night. The Japanese-style room is 18 degrees C - 20 degrees C under the influence of living daytime. It is not heated like [a Japanese-style room] living most night. The main bedroom is made into the setting temperature of 15 degrees C. Although heating is hardly used through one day, the extreme temperature fall is not produced.

(2)Summer temperature measurement result

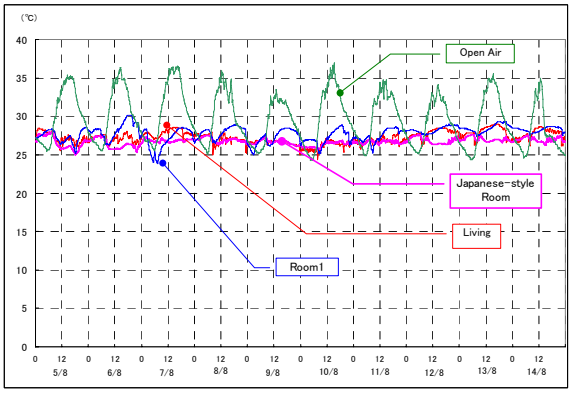
Since solar heat is covered well, there is no necessity of making air conditioning temperature low extremely. The temperature of each room is 25 degrees C - about 28 degrees C.

(3)The amount of photovoltaic system power generation

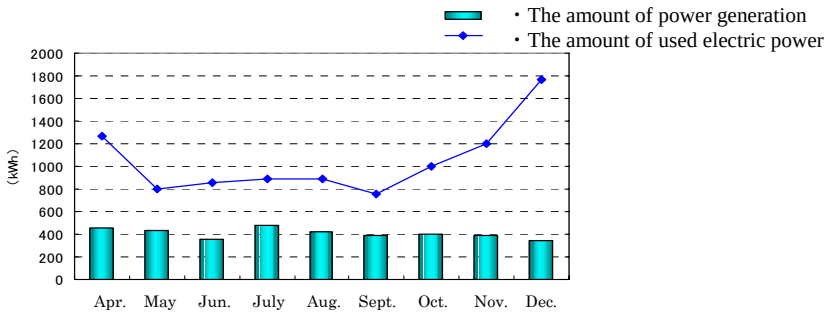
Since on the south is opened wide and sunlight can fully be obtained, about 400kW has been generated constantly every month. 3690kW of about about 90000 yen is generated in the sum total in April - December. The abbreviation half is provided in May - September with little electric use by power generation of a photovoltaic system.



Temperature of a winter



Temperature of a summer



The amount of photovoltaic system power generation

Costs

The expense, which starts when these systems are carried, is as follows. It costs 1,800,000 yen to carry a whole building air-conditioning ventilation system. It costs 3,300,000 yen to carry photovoltaic. It costs 450,000 yen to carry a passive solar system. It costs 250,000 yen with the difference that changes a gas hot-water supply machine and a gas range into electrical machinery. Sum total expense changes to 5,800,000 yen.

Planning tools for LCA, energy performance, solar energy design and more

Special tools and analyses done for the building.

Marketing strategy

By the ability of a resident to use the subsidy obtained by carrying these system , we are raising the rate of system loading.

The subsidy of the "residence and building efficient energy system introduction promotion base enterprise" of NEDO (New Energy and Industrial Technology Development Organization) is received for a passive solar system, a central air conditioning ventilation system, an IH cooking heater, and housing heat insulation strengthening. A subsidy frame is 1/3 of the expense concerning the object system, and changes to about 1,200,000 yen in this residence.

Other information

These systems are studied at the MITSUBISHI Estate home – Comfortable air research institute.

Common text about Task 28

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