B-16.1 Promotion of an Insulated Construction House to Control and Reduce Carbon Dioxide Emissions from Residential Sector.

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Total Budget for FY1991-FY1993 25,938,000 Yen (FY1993; 9,116,000 Yen)

Abstract A new conventional wooden construction house, which mainly differs in the amount of insulation and construction method was investigated using simulation model. Construction method was also discussed. Comparison of annual carbon dioxide emission from house construction process and emission from residence for various house insulation, infiltration and equipment level were conducted. Estimated annual carbon dioxide emission rate from house construction process was 407(Ckg/house). In this estimation life time of house is assumed 30 years.

Annual carbon dioxide emission rate from residence in seven cities were estimated under the six types of specification of insulation and infiltration levels and equipments.For the base case emission of carbon dioxide from new insulation and infiltration level house which is presently used for new construction was estimated. For example in Sapporo and Tokyo showed 3152 and 2281(Ckg/household) respectively. For the case of super insulated and low infiltration construction house this value is decreased to 2010 and 1423(Ckg/household) respectively. This reduction rate of carbon dioxide is much higher than the emission of house construction processes, and it was found that the promotion of an super insulated and infiltration construction house is very efficient to reduce carbon dioxide emission from residential sector.

Key Words Super Insulated Construction Houses, Low Infiltration Construction House, Wooden Construction House, Eco-house

1. Introduction

Carbon dioxide emission from residential sector of Japan has been increasing reflecting the change of living quality and life style. Growing rate of energy consumption from residential sector during 1980 and 1990 is more than 24%. Carbon dioxide emission rate from residential sector is approximately 23% comparing with the whole carbon dioxide emission in Japan, and 12% is household emission. As countermeasures to cope with global warming it is important to establish the control and reduction system of carbon dioxide from residential sector

2. Research Objective

Average emission share from residential sector shares by house heating,air conditioning, hot water supply, and other use like motive power and lighting are approximately 27%,2%,36% and 35% respectively. In Hokkaido and Tohoku district emission share by house heating are more than 66% and 42%, and promotion of insulated construction house will be efficient to control and reduce carbon dioxide emission from residential sector.

Insulated construction house and low infiltration construction house is being widely used in Hokkaido district to improve the house heating efficiency in winter time, but these houses are not much popular in another part of Japan.To promote the use of low energy house it is necessary to improve the information exchange between house user, house maker, house equipment maker, constructor, architect and researcher. In this study the present technical status of low energy house is discussed.

3. Research Method

A New conventional wooden construction house, which mainly differs in the amount of insulation and construction method, was investigated and compared with different insulation construction conditions. Super insulated construction house is widely used in Hokkaido district. Almost more than 20% of newly constructed house in 1993 are insulated construction house in Hokkaido and this percentage is expect to exceed more than 90% within few years.

For the first step "new conventional wooden construction house", which is mainly different from the amount of insulator and construction method, was investigated comparing with four different insulated construction conditions. Calculated results showed kerosene consumption of the house in Tokyo area is reduced one third comparing with conventional wooden house and new conventional wooden house, which is commonly used in Hokkaido district. Living condition is also improved.

To understand this more qualitatively A new conventional wooden construction house was investigated using simulation model.Construction method was also discussed.

4. Results and Discussion

Comparison of annual carbon dioxide emission from house construction process and emission from residence for various house insulation, infiltration and equipment level were conducted.

Annual carbon dioxide emission rate from house construction process and annual carbon dioxide emission rate from residence of two types model house,two stories house and partly two stories house ,under the six types of specification of insulation and infiltration levels of house and equipments as follows;

(1)New insulation and infiltration level which is presently used for house construction.
(2)Super insulated and low infiltration construction house
(3)Super insulated and low infiltration construction house &
(+Solar water heating system)
(4)Super insulated and low infiltration construction house &
(+Multiple purpose heat pump system)
(5)Super insulated and low infiltration construction house &
(+Solar water heating system +Multiple purpose heat pump system)
(6)Super insulated and low infiltration construction house &
(+Solar water heating system+Multiple purpose heat pump system +Solar battery system)

For air conditioning two types such as continuous air conditioning for all rooms and intermittent air conditioning for selected rooms were calculated. Results for Sapporo and Tokyo cases are shown in Figure 1. Estimated annual carbon dioxide emission rate from house construction process was 407(Ckg/house) as shown in Figure1. In this estimation life time of house is assumed 30 years.

Annual carbon dioxide emission rate from residence in seven cities were estimated under the six types of specification of insulation and infiltration levels and equipments. For the base case emission of carbon dioxide from new insulation and infiltration level house which is presently used for new construction was estimated. For example in Sapporo and Tokyo showed 3152 and 2281(Ckg/household) respectively as shown in Figure1. For the case of super insulated and low infiltration construction house this value is decreased to 2010 and 1423(Ckg/household) respectively.

This reduction rate of carbon dioxide is much higher than the emission of house construction processes.Calculated results showed that the carbon dioxide emission from the house is reduced 20～40% compared with conventional wood house and the new conventional wood house.It was found that the promotion of an super insulated and infiltration construction house is very efficient to reduce carbon dioxide emission from residential sector.

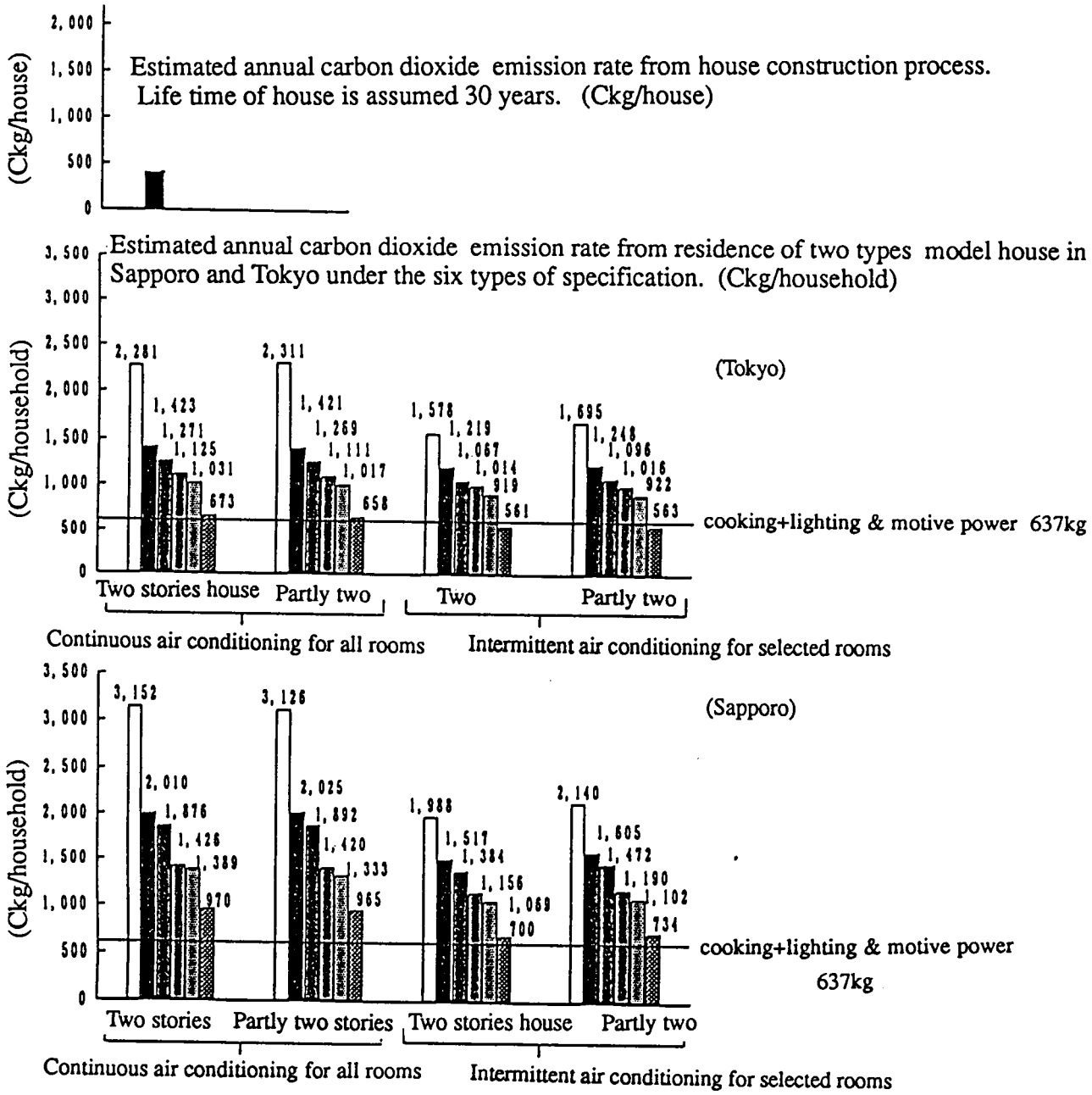

Figure 1. Comparison of annual carbon dioxide emission from house construction process and emission from residence for various house insulation, infiltration and equipment level.

Specification of insulation and infiltration levels of house and equipments

- ☐ New insulation and infiltration level which is presently used for house construction
- ■ Super insulated and low infiltration construction house
- ■ Super insulated and low infiltration construction house (+Solar water heating system)
- ■ Super insulated and low infiltration construction house (+Multiple purpose heat pump system)
- ■ Super insulated and low infiltration construction house (+Solar water heating system +Multiple purpose heat pump system)
- ■ Super insulated and low infiltration construction house (+Solar water heating system +Multiple purpose heat pump system +Solar battery system)

5. Summary

Comparison of annual carbon dioxide emission from house construction process and emission from residence for various house insulation, infiltration and equipment level were conducted. Estimated annual carbon dioxide emission rate from house construction process was 407(Ckg/house). Annual carbon dioxide emission rate from residence in seven cities were estimated under the six types of specification of insulation and infiltration levels and equipments.

For the base case emission of carbon dioxide from new insulation and infiltration level house which is presently used for new construction was estimated. For example in Sapporo and Tokyo showed 3152 and 2281(Ckg/household) respectively. For the case of super insulated and low infiltration construction house this value is decreased to 2010 and 1423(Ckg/household) respectively. This reduction rate of carbon dioxide is much higher than the emission of house construction processes, and it was found that the promotion of an super insulated and infiltration construction house is very efficient to reduce carbon dioxide emission from residential sector.

To promote the use of the low energy houses it is necessary to improve the information exchange between house owners,house makers, house equipment makers, constructors, architects and researchers.Meteorological conditions, contruction method and construction costs combined with the social system must be also considered.