B-16 Control and Reduction System of Carbon Dioxide Emission form Residential Sector.

Contact Person Shinji Wakamatsu
Section Director
Regional Environment Division, Urban Air Quality Research Team,
National Institute for Environmental Studies, Environment Agency.
Onogawa 16-2, Tsukuba, Ibaraki, 305 Japan
Phone :+81-298-51-6111(Ext.453) Fax:+81-298-51-4732

Total Budget for 1991-1993 113,685,000 Yen (FY1993; 38,683,000 Yen)

Key Words Super insulated and low infiltration construction house, Eco-house, Domestic energy consumption, Environmental Education

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. Improve the information exchange between house user, house maker, house equipment maker, constructor, architect and researcher.

Hot water supply using solar panel is efficient and popular way of solar energy use to control and reduce carbon dioxide emission from residential sector. To investigate this solar heat collecting system was designed to form part of the roof construction. As a result the durability of solar heat collector increased remarkably. Observed overall reduction rate of kerosene is approximately 50%. The data observed from natural energy using house was analyzed. Observed living room temperature showed small daily variation and higher difference with outside temperature due to the super insulation and low infiltration of house and natural energy system such as passive solar material and cool tube.In considering Ech-house system human feeling in the room is another important aspects.To investigate this artificial wind flow system was applied for model house. Observed result showed that even if room temperature goes up more than 27 degree C comfort zone is observed if wind speed is 0.4 to 0.6 m/s. Energy consumption of this artificial wind flow system is one tenth comparing with electric cooler in summer season.

Regional characteristics of the thermal performance of the houses and the occupant's behavior in winter time was analyzed focusing on Tohoku district and Sendai area. Comparison study with the result which observed ten years before showed living quality of Tohoku district is improving. Future trend of carbon dioxide from household in Sendai is also estimated. Annual increase of total emission between 1990to 2000 is 3.59% and between 2000 to 2010 it is 1.29%. Wind tunnel Study was conducted to clarify the relationship between model house locating interval and natural ventilation rate of house. Air change rate per hour decreases as model interval decrease due to the decrease of pressure difference especially at wall point measurement between windward wall and leeward wall. When air comes from windward roof air change rate per hour showed small difference against the changes of model interval.

Nation wide actual residential energy consumption data was analyzed and estimation formulas of different use of energy were presented with discussion on determinant factors of residential energy consumption. In addition a text book dealing with knowledge and concept which is necessary in order to help lifestyle with low carbon dioxide emission rate,has been developed. The textbook is designed to be understandable for people elder than junior high school students.