

SUMMARY OF Ph.D. DISSERTATION

| | | |
|--|-------------------------------|---|
| School School of Science for OPEN and Environmental Systems | Student Identification Number | SURNAME, First name MIZUTA, Kazuhiko |
| Title Study on Reduction of Greenhouse Gases from Renovating Thermal Insulation in Houses | | |
| Abstract <p>CO₂ emissions from houses are still increasing in Japan. As thermal insulation performance in houses has been improved mainly in newly built ones, it is necessary to improve the thermal insulation performance in large numbers of existing houses to reduce the total amount of energy consumption in heating/cooling apparatus. This study describes the effect of renovation of thermal insulation utilizing LCCO₂ (life cycle CO₂ assessment) with regard of thermal insulation materials. At first, two types of fundamental experiments were carried out. One is to estimate long term aging of thermal conductivity for cellular plastic insulation materials (polyurethane spray foam) for performance degradation. Another is to renovate outer wall with injecting polyurethane foam as a simple renovation method.</p> <p>With adopting these two experiments, the LCCO₂ reduction effect by renovating thermal insulation in standard house model was simulated in terms of following three aspects; 1)Renovation effect to LCCO₂ reduction for 100 years considering aging of thermal conductivity, 2)Estimating LCCO₂ level on the basis of the experimental results injecting polyurethane foam into walls, 3)LCCO₂ reduction effect from renovating windows and walls.</p> <p>Furthermore the renovation effect for all houses in Japan is estimated up to 2020 with considering the aging of thermal conductivity. Greenhouse gas emissions from all houses will increase by 5% compared to that of 1990 without improving current insulation performance in 2020. However, with renovating walls and windows, greenhouse gas emissions can be reduced by 14.4% in 2020 if renovation was carried out at a constant annual rate from 2007. Similarly, renovation with all parts (wall, ceiling, floor, and window) enables a 23.5% reduction in 2020.</p> <p>Economic evaluation for renovating thermal insulation reveals cost per amounts of CO₂ reduction would be higher than installing some building equipments. Subsidy for renovation seems to be necessary.</p> | | |