平成２９年度　環境科学院　修士論文内容の要旨

Cross Cultural Investigation on Heating System between Sapporo City and Tianjin City during winter season

(冬期間の札幌市と天津市の暖房システムに関する異文化間調査)

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Under the pressure of exhaustion of energy resources and heavy environmental impacts, the rapidly growing energy use is raising more concerns around the world. Especially in northern cities with the rapidly growing population and the improve of living standard, the energy consumption by space heating accounts for the largest proportion in a residential house. Sapporo city as a pioneer accomplished the energy source transition from coal to oil decades earlier than Tianjin city. In order to take suitable actions for the local circumstances, it is necessary to investigate the history and current situation of space heating in each city. The results of the investigation should be helpful to gain a comprehensive understanding of space heating system, figure out energy saving potential and offer appropriate control strategies for each city.

Weather data analysis by EnergyPlus was combined with the typical building energy simulation by eQUEST in each city. The results of the simulation pointed out many vulnerable problems about the central heating system of Tianjin city. For example, residents have to stand about 21 days according to the simulated thermal environment temperature. Because in the traditional heating system, residents don't have a way to control the heating operation. Architectural design, HVAC (Heating, Ventilation and Air Conditioning equipment), building type and size, floor plan layout and construction materials were the factors that affect the efficiency of heating system. High thermal insulation technologies and residential energy saving concepts of the two cities should be introduced. Furthermore, the investigation on the residents' behavior for space heating was also carried out in each city. 321 informants were obtained in Sapporo and 489 in Tianjin. Through the residents' behavior comparison of the two cities, a great number of energy was wasted by lacking the thermostatic radiator valves and the defective billing system in Tianjin. Comparing with Tianjin, heating system of Sapporo is high self-control and residents have a strong sense for energy saving because the bill system is charged by the amount. Therefore, enhancing the performance of the exterior was the most effective way on reducing space heating intensity in both cities. On the other hand, energy source, thermostat and payment systems for the central heating should also be reconsidered by the policy makers of Tianjin city.