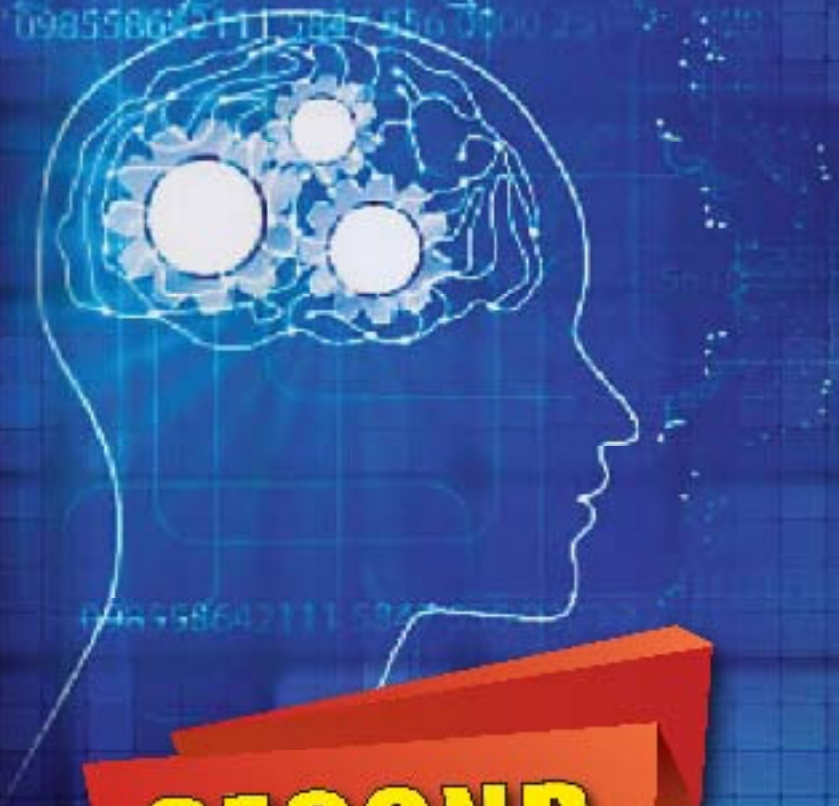
THE DOCTORAL RESEARCH ABSTRACTS

Volume: 2, Issue 2 Nov 2012



SECOND ISSUE

INSTITUTE of GRADUATE STUDIES

Leading You To Greater Heights, Degree by Degree

IPSis Biannual Publication

10

Name : **Salmah Bt Ahmed**

Title : **Development of Integrated Daylighting and Natural Ventilation System for Energy Efficiency in Buildings for the Tropics**

Faculty : **Applied Sciences**

Supervisor : **Prof. Dr. Azni Zain Ahmed** (MS)

Natural ventilation and daylighting are two passive strategies that can improve the indoor performance as well as reduce energy consumption in buildings. Both strategies when used appropriately increase indoor quality and comfort. In terms of energy costs, daylighting can significantly reduce artificial lighting as well as heat dissipated from the resulting fixtures while natural ventilation can minimize the need for air-conditioning. This research was conducted to develop an integrated system, which combined the daylighting and natural ventilation specifically for energy efficiency in buildings in the tropical countries like Malaysia. The system, named as Daylight-Natvent System, was designed in such a way that, it uses the heat from the sun's light to induce the natural stack effect inside the building, thus creating air movement, whilst captures, reflects and transmits

daylight into interior space. With the impending threat of global warming and pollution, the system can thus offer an effective solution to reduce such problems while providing savings in total building energy consumption as it can reduce or even eliminate the installation of active energy consuming measures. Using research data conducted in local climatic conditions and utilization of as many locally available materials as possible, the system was specifically developed for use in residential houses or offices in hot humid, tropical conditions. The challenge was the creation of a triple function system which can extract hot air out of attic spaces, create indoor air movement and provide daylight with minimal dissipation of heat to the interiors. The development of the system, which includes obtaining the optimum dimensions and material, involved assessments and evaluation of thermal and airflow performances using Computational Fluid Dynamic (CFD) simulations and daylight performance evaluation using physical modeling. To really assess the performance of the integrated system, prototypes were built based on the predicted results by taking into consideration the materials chosen to ensure that it was economically viable. Evaluations on the performance of the prototypes were carried out in the full scale test cell in the campus of University Teknologi MARA. It was found that the system could provide an average internal illuminance of 344 lx, a level sufficient for indoor visual comfort. A simple analysis on the potential electricity energy saving upon using light pipe showed that an amount of 78.84 kWhr could be saved per room in one year for lighting, which in this case is equivalent to 4.93 $kWhr/m^2.yr$. In terms of ventilation, the monitoring results indicated that the performance of the integrated system was the same as the existing turbine ventilator, which improved the indoor air movement by 26.5%. In general, the newly innovated system has demonstrated very positive lighting performance besides maintaining the good ventilation performance of the original system for the improvement of indoor environment in the tropics.