

Personal Environment Comfort System (PECS) for Improving Thermal Comfort and IAQ in a Zero Energy Building

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ABSTRACT

A new net Zero Energy Building (ZEB) research office building is designed, constructed, and operated in Tsukuba. Groundwater heat source and woody biomass gasification combined heat and power system are installed. Together with Biomass CHP plus PV power supply energy during daytime to meet power demand. Energy management system (EMS) with PV panels and storage batteries makes stable operation even under the conditions where reverse power flow to the power grid is not permitted. To increase workplace productivity the concept of ABW (Activity Based Working) is introduced where they can freely select working place. Of course, they can move their own working place with preference. When they like to work continuously at the same place, they can create their own preferred environment with Personal Environment Comfort System (PECS). Therefore, we have developed three types of PECS that meet various needs. In addition, this PECS has high energy efficiency that uses groundwater as a cold heat source in the summer and exhaust heat from biomass CHP as a heat source in the winter. Also, during intermittent season natural ventilation is applied with openable window. We developed a smart control system for PECS and occupants can easily adjust air volume, temperature with their smart phone. Occupant satisfaction including thermal comfort and indoor air quality were monitored and analysed. As a result, we confirmed the very high occupants' satisfaction. In addition we picked up highly used occupant group with more than 10 times or more. During certain period we prohibited to use PECS. As a result, environment satisfaction for them is dramatically downed. Office workers using personal air conditioning on a regular basis, summer operating conditions in a typical office (26°C/45% RH), was confirmed that it is possible to further improve indoor environment satisfaction. PECS can say diversity HVAC system.

KEYWORDS

Personal system, Thermal comfort, Indoor air quality, Occupant satisfaction, Net Zero

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