Abstract

Currently, condominiums share proportion of 45 percent of all residential buildings. Most of them consist of rooms with a single-sided opening that do not support natural ventilation and residents need consuming electricity for air conditioning. However, the power generation by burning fuels produces greenhouse gases emissions, turning out the global warming. This research studies the efficiency of natural ventilation by applying a single-sided opening for high-rise residential units and the effect on thermal comfort and energy savings. The study focuses on the effects of the width of wing walls, the distance between the openings, the balcony and the depth of interior wall between openings for the wind direction of 0, 15, 30, 45, 60, 75 and 90 degrees on the ventilation to the residential unit. By using Computational Fluid Dynamics (CFD), the simulation results are measured in terms of the coefficient of average air velocity and the coefficient of standard deviation. The results show that the width of wing walls of 2 meters with the distance between the openings of 2 meters in wind direction of 30, 45 and 60 degrees and the width of wing walls of 4 meters with the distance between the openings of 4 meters in wind direction of 45, 60 and 75 degrees, increase ventilation effectively to residential unit. The balcony can increase the wind velocity in the room, if the wind direction is 90 degree. The length of the interior wall between the openings of 2.5 meters is recommended for the residential unit of 6 x 6 m^2. Taking into account the pressure coefficient for square-tall building, the results show that for the wind direction between 0 and 15 degrees, room at the upstream wind may obstruct the wind to room at the downstream wind. For the direction of 30, 45, 60 and 75 degrees, wind direction is oblique with the room that appropriate to use the wing walls to increase air velocity within the room. For the wind direction of 90 degree, the air velocity within the room tends to increase from the room at middle to the room at the edge of a building. Therefore, the residential units with good ventilation should be located at the edge of the building with the upstream wind. The calculated results of the number of hours in the thermal comfort zone for a room with good ventilation is 36.78 percent of the total

number of hour in one year. The amount of greenhouse gas emissions in terms of Carbon Dioxide Equivalent (CO_2e) reduction, preliminary showed the reduction of the emission of CO_2e up to 3,976.59 kg. per year per room. The results in this study show that for a single-sided opening room in the condominium, there is a potential to apply natural ventilation as the appropriate design of wing walls, opening and interior wall. In addition, the results also show the decrease of electricity consumption and help reduce global warming.