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Comprehensive Approach to Control Virus Infection and Energy Consumption in An Occupant Classroom

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Abstract : People nowadays spend most of their time in buildings. Accordingly, maintaining a good quality of indoor air is very important. New universal matters related to the prevalence of Covid-19 also highlight the importance of indoor air conditioning in reducing the risk of virus infection. Cooling and Heating of a house will provide a suitable zone of air temperature for residents. One of the significant factors in energy demand is energy consumption in the building. In general, building divisions compose more than 30% of the world's fundamental energy requirement. As energy demand increased, greenhouse effects emerged that caused global warming. Regardless of the environmental damage to the ecosystem, it can spread infectious diseases such as malaria, cholera, or dengue to many other parts of the world. With the advent of the Covid-19 phenomenon, the previous instructions to reduce energy consumption are no longer responsive because they increase the risk of virus infection among people in the room. Two problems of high energy consumption and coronavirus infection are opposite. A classroom with 30 students and one teacher in Katowice, Poland, considered controlling two objectives simultaneal. The probability of transmission of the disease is calculated from the carbon dioxide concentration of people. Also, in a certain period, the amount of energy consumption is estimated by EnergyPlus. The effect of three parameters of number, angle, and time or schedule of opening windows on the probability of infection transmission and energy consumption of the class were investigated. Parameters were examined widely to determine the best possible condition for simultaneous control of infection spread and energy consumption. The number of opening windows is discrete (0,3), and two other parameters are continuous (0,180) and (8 AM, 2 PM). Preliminary results show that changes in the number, angle, and timing of window openings significantly impact the likelihood of virus transmission and class energy consumption. The greater the number, tilt, and timing of window openings, the less likely the student will transmit the virus. But energy consumption is increasing. When all the windows were closed at all hours of the class, the energy consumption for the first day of January was only 0.2 megajoules. In comparison, the probability of transmitting the virus per person in the classroom is more than 45%. But when all windows were open at maximum angles during class, the chance of transmitting the infection was reduced to 0.35%. But the energy consumption will be 36 megajoules. Therefore, school classrooms need an optimal schedule to control both functions. In this article, we will present a suitable plan for the classroom with natural ventilation through windows to control energy consumption and the possibility of infection transmission at the same time.

Keywords : Covid-19, energy consumption, building, carbon dioxide, energyplus
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