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Optimization of energy consumption in the building of department of physics, university of Tehran

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Abstract

The purpose of this study is to reduce the temperature of the attic of the building of department of physics in university of Tehran. To achieve this goal, eighteen natural ventilators with the area of 0.25 m² each were installed on the roof. The natural ventilators alone did not decrease the temperature significantly. To help natural ventilation, a laminar flow of air from the floors to the attic was provided. This led to a temperature decrease around 1.5 to 2° C. In addition, a powered ventilation was resulted 3 to 8° C temperature decrease. Since the volume (4533 m³) and area (1416 m²) of the attic are too large, further tests were conducted on two small models (47×33×51 cm³) of the attic, build from the same material as the main attic. The models were used to investigate the effect of covering the roof with aluminum foil and painting the roof with a white color as a reflector, and installation of polystyrene panels under the roof as an insulator. Covering with aluminum foil, painting in white, and installation of polystyrene resulted in 3-5, 2-3.5, and 1-2 degrees decrease in temperature, respectively. Reason of these changes was explained by reflection spectrum of UV-Vis-NIR spectrophotometry. Finally, the attic was simulated by the COMSOL Multiphysics software. It showed that a temperature reduction of 10 degrees could be accomplished by installation of six fans as inlet in the gables, three in each gable. Each fan has to generate 4 m/sec air flow velocity.

Keywords: energy consumption, optimization, aluminum foil, white color, polystyrene, COMSOL

For full article, refer to the Persian section