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The Effect of Solar Chimney Layout on Ventilation Rate in Buildings

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Abstract

Design of solar chimney in buildings is considered as one of the passive ventilation methods enhancing the ventilation for adjacent spaces through renewable energy of sun and applying chimney effect phenomenon in an air canal. The layout of solar chimney in different parts of the building affects the ventilation rate and performance of solar chimney due to its effect on air flow rate. This research examines the performance of solar chimney based on its layout in southern, west-southern and east-southern part of the building. Then, the performance of solar chimney is compared in the plan center and southern façade-connect part. To achieve these objectives, EnergyPlus software was used to simulate the performance of solar chimney connected to a typical seven-story office building located in Isfahan. The results were presented in terms of two parameters including building layout and materials of the walls and glasses. The results show that locating solar chimney in east-southern part of the building provides maximum ventilation rate due to the maximum radiation and two side absorbing wall. It was also found that every solar chimney provides necessary ventilation rate for spaces attached to it.

Keywords: Solar Chimney, Ventilation, Energy Simulation, Energyplus Software, Layout

1. Introduction

Various factors affect indoor air quality in buildings. Insulating the building and suitably sealing the openings to reduce thermal loss make the pollution exacerbated since there is no air penetration or leakage out. Therefore, ventilation is inevitable. Using inactive system in building ventilation resolves this problem and is a step toward reduction of energy consumption and environmental pollution.

Solar chimney is a thermosyphon solar inactive system which improves the indoor air quality by enhancing natural ventilation in the building due to chimney effect [2]. Solar chimney is similar to conventional chimney except its south-ward wall is glass. Solar rays pass the glass and are absorbed by absorbing wall surface to warm the air inside chimney. Because of chimney effect, the air is warmed and contracted less which makes it move upward. This upward movement

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