

## The effects of opening areas on solar chimney performance

### ABSTRACT

To enhance natural ventilation at day time, solar chimney is one of the suitable options for tropical country like Malaysia. Solar chimney creates air flow due to stack effect caused by temperature difference between ambient and inside wall. In the solar chimney, solar energy is harvested by the inner wall that cause temperature rise compare to ambient. Therefore, the efficiency of the solar chimney depends on the availability of solar energy as well as the solar intensity. In addition, it is very hard to get good ventilation at night time by using a solar chimney. To overcome this problem one of the suitable valid option is to integrate solar chimney with turbine ventilator. A new type of solar chimney is designed and fluid flow analyzed with the computational fluid dynamics (CFD) software. The aim of CFD and theoretical study are to investigate the effect of opening areas on modified solar chimney performance. The inlet and outlet area of solar chimney are varied from 0.0224m<sup>2</sup> to 0.6m<sup>2</sup> and 0.1m<sup>2</sup> to 0.14m<sup>2</sup> respectively based on the changes of inclination angle and gap between inner and outer wall. In the CFD study the constant heat flux is considered as 500W/m<sup>2</sup>. CFD result shows that there is no significant relation between opening areas and the air flow rate through solar chimney but the ratio between inlet and outlet is significant on flow performance. If the area ratio between inlet and outlet are equal to two or larger, the performance of the solar chimney is better than the solar chimney with ratio lesser than two. The solar chimney performance does not effect if the area ratio between inlet and outlet varies from 1 to 2. This result will be useful for design and verification of actual solar chimney performance.