Review on the Performance and Efficiency of Solar Chimney- A Passive Ventilation Strategy

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ABSTRACT
This study is concerned with the feasibility of solar chimney and the effect of opening on the ventilation rate to reduce heat gain in the house and improving night ventilation. Passive ventilation is being proved to be an alternate approach to the mechanical ventilation system because of their potential benefits such as carbon-di-oxide emission, energy requirement and operational cost. The solar chimney has been the subject of remarkable research and analysis since the 1990's. This article presents an overview of the past work carried out on solar chimney in the last two decades. The main focus of the review is on the effect of geometry, inclination and improving the performance of solar chimney. A valuable amount of previous research and analytic works supports the literature of this paper. Moreover this article found that a lot of work is required yet for the solar chimney as a passive ventilation strategy.

Keywords: ventilation, thermal buoyancy, convection, radiation and chimney

1. INTRODUCTION

The architects and building engineers have to search for the alternate of heating, cooling and ventilating buildings as per the prospects of global warming. The energy consuming mechanical device for conditioning of room/building must be replaced by passive means. The houses can be designed and built to maintain thermal comfort according to weather condition. It is possible to oust completely the energy consuming mechanical system for thermal comfort by utilizing passive system, depending on tolerance to high temperatures. Solar cooling is the most effective means to keep the building away from the sun's thermal energy. This is most effectively fulfilled, but tropical landscape is away, most design sinks rapidly in many hot and humid climates, while using movable devices shading the dwelling's windows, walls and roof. Thermal mass in buildings, evaporative cooling and radiative cooling are the other passive cooling techniques but cannot be favorable in tropical countries because the mean daily temperature is relatively high [1-4]. Passive cooling approach should be applied to control energy consumption for the cooling of the building. By creating a hot zone at the outlet of system, fresh air can replace the stale air by pushing the warm air out of the system due to density difference, which ventilates the whole structure and also comforts the occupants. Since the potential of solar energy is high in such region, the hot air can be withdrawn at a slightly higher speed by constructing hot zone with a black metal sheet on the glazing element. Applications of solar chimney in building are restricted to outer wall [5].

Solar radiation is an important source of heat gain in and through building envelope. A key approach for cooling of building without any mechanical system in hot humid climates is to boost natural ventilation. During summer season in hot arid region the ambient temperature is almost between 42-47^{o}C, direct ventilation is not proposed because of inadmissible gain of heat by convection. Improper ventilation may lead to thermal discomfort for building occupants. Unsuitable climatic responsive building utilizes large amount of cooling energy to countervail the overall heat gain caused by the above mentioned surface. Most of the buildings consume energy mainly for thermal comfort such as heating, cooling and lighting purposes. Ventilation may be defined as the supply of outside air to the building interior for the movement of air and replacement of stale or rancid air by fresh outside air for healthy and convenient interior environment. Natural ventilation can be achieved either by thermal buoyancy or by wind. For example, when wind strikes the building, a positive pressure is generated on the windward side and on the leeward side of the building there is a negative pressure. This pressure difference plays a vital role to start ventilation by allowing fresh air from outside to flow inside the building through windward side and leave the building through the leeward side. This system is also known as wind driven cross ventilation.

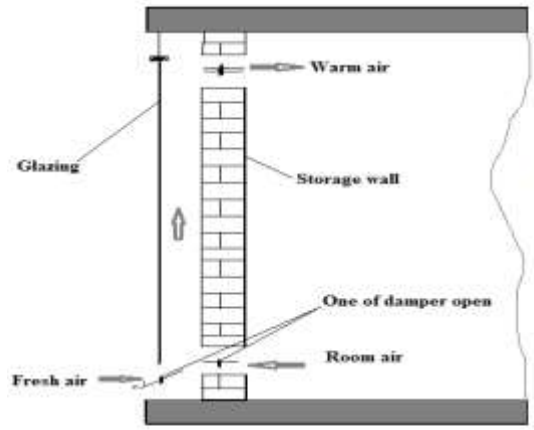
The air motion through the building can take place in two ways (i) aero-motive or wind force (ii) thermal temperature forces of stack effect. Across the building in the direction of the building a pressure gradient is generated. The air flow in the building take place due to this pressure gradient from the blank space provided in the region of higher pressure to the open space located in the region of lower pressure [7]. The patterns of pressure changes can be described as:
(i) The pressure of air on either side of opening will be equalized, when a single opening is provided at a certain level inside the building, after which air is not allowed to flow through the opening in-spite of the difference in temperature.
(ii) When the indoor temperature is higher than outside and two openings are provided at different heights, pressure difference is created in such a way that at the upper opening the excess indoor pressure starts building up and the depression is created at the lower level due to which the air flows outward [8].

To uplift the thermal driving force or stack effect a significant amount of temperature difference should be there. A huge amount of temperature difference can be created with the help of solar energy, and hence improve the stack effect for space natural ventilation [9]. If the temperature outside is lower than that inside, therefore lower parts will have lower pressure and the upper parts of the building will have higher pressure. Air enters through the lower opening and escapes through the upper opening. The air flow can be reversed in case the outdoor temperature is higher than indoor temperature [7]. Due to the pressure difference across the openings air is driven in and out of the openings, which are due to the cumulative effect of buoyancy driven force and wind. Depending on atmospheric conditions, the indoor thermal comfort can be achieved by natural ventilation without any mechanical cooling aid [10].

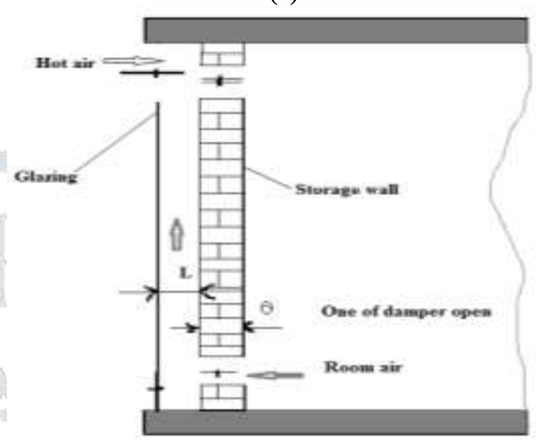
Karema E Amori pointed out that for improving the natural ventilation of the building by using passive solar energy for convection of heated air solar chimney is most preferable. Heating and cooling of living spaces by the use of sun's energy is known as passive solar design. Operating windows, chimney and thermal mass are the key elements found in passive solar design [11]. Pavel Charvet & Joseph Stetina describes solar chimney as a natural draft device which utilize solar radiation for moving air upward, hence converting solar energy into kinetic energy of air. The density of air decreases with increase in temperature while pressure remains constant. Due to the buoyant force air with the temperature greater than ambient rise upward. Solar chimney utilizes this physical phenomenon for conditioning of room [12]. Solar chimney can be defined as a vertical chimney with one or more walls of chimney are made transparent by providing glazed walls to capture solar radiation as a result the air inside chimney got heated. A natural convection of air flow is thermally induced due to the difference in density of air between the inside and outside of chimney [13]. Solar chimney can be defined as an absorber of solar energy with an opening on both sides of the passage top as well as bottom, which forces air to flow through a building when solar radiation hits the upper most surface of the chimney. The buoyant force experienced determines the rate at which air is drawn through the room, (i.e. depends upon temperature difference), resistance offered to the entry of fresh air within the room and resistance to air flow through the chimney. The main purpose of solar chimney is to provide ventilation for cooling, but when a fan is used to force the warm air into the building provides heating effect also. A solar chimney can be considered as a special case of Trombe wall or thermo-syphoning air panel. A Trombe wall utilizes a part of the wall of a building normally taken up by glazing and has a disadvantage that it occupies wall area and causing a loss of day light and outer view [14].

A Trombe wall is a concrete or masonry wall facing toward south with an exterior blackened and covered by glazing. It is a massive thermal wall used to serve as solar energy collector. The stored solar energy is utilized for both summer and winter season it is transferred inside the building for heating in winter season and facilitates the movement of air within the room for summer season. Trombe wall's operation for heating and cooling are shown in figure.1 [15]. Joseph Khedari et al. discusses the modified Trombe wall (MTW) under atmospheric conditions in Bangkok to find the feasibility of lowering the transfer of heat in to the house (insulating effect) and inducing natural ventilation. A gypsum wall, a masonry wall, an air gap, and a gypsum ceiling are its components.

It was found that the design specification for the modified Trombe wall with $2m^2$ of surface area, air gap of 14cm and for inducing higher natural ventilation rate of about 20-90m^3/h a dark colour is applied over it. The lower rate of the wall can be induced by its light colour, but was still significant for the ventilation of houses. To achieve thermal comforts of the house with such air flow rate there is a small potential to induce appropriate ventilation. However, new construction house is recommended for the proposed Modified Trombe Wall configuration because of high insulation effect [16].



(a)



(b)

Fig. I. An illustrated diagram of two types of Trombe walls: (a) for winter heating and (b) for summer cooling.

2. PREVIOUS STUDIES

Hocevar and Casperson (1979) performed experiment on a Trombe Wall of 2.2m high to observe the velocity, temperature magnitude and profiles in the gap (width size varying from 2.5 to 20cm) for ventilation, the elevation above the Trombe wall inlet duct, ambient temperature, insolation rate, wall temperature, and so the function of gap width throughout the day [17]. Akbarzadeh (1982) shows experimentally the flow visualization studies of a Trombe wall of 2.66m with air gaps varying from 0.10 to 0.35m [18].

Bouchair and Fitzgerald (1988) conducted a theoretical study using finite difference technique and observed the heat stored in solar chimney and found that the azimuth plays an important role to find the amount of heat storage [19]. A.K Sharma & N.K Bansal (1989) et al. conducted experiments at New on a small sized vary therm wall. The experimental set-up was prepared by fixing a plywood panel (1.2×1.2 m^2) in front of a brick wall facing west of thickness 12cm of an existing building. The buff colour was painted on a plywood panel, but the natural red colour was left on the brick wall. All walls of the room of measurement 2.5×4.0m are 12cm thick and the concrete roof of 17cm thickness. Thermocouples are fixed to the vary-therm wall as well as to an adjoining section of normal brick wall to measure the temperature of the room. While performing the experiment, due to the heat inflow and outflow the temperature of the room is varied considerably through the brick walls. To maintain the room at constant temperature no measures has been taken, but the room was almost cut-off from the ventilation [20].

In Nigeria, Barozzi (1992) et al. have conducted an experimental and numerical study to analyze the thermal performance of a bio-climatic building prototype. The inclined roof itself generates airflow through the building's living space in the form of a solar chimney. A good agreement between experimental and theoretical analysis were shown in an experiment conducted on a 1:12 small scale model of the prototype [21]. N.K. Bansal (1993) investigates solar critical design parameters such as height, cross-section area and the difference in temperature at inlet and outlet of the solar air heating system. During the day air inside the solar collector gets heated, the heated air inside the chimney expands and rises upward, in turn pulling fresh air in and interior air out [22].

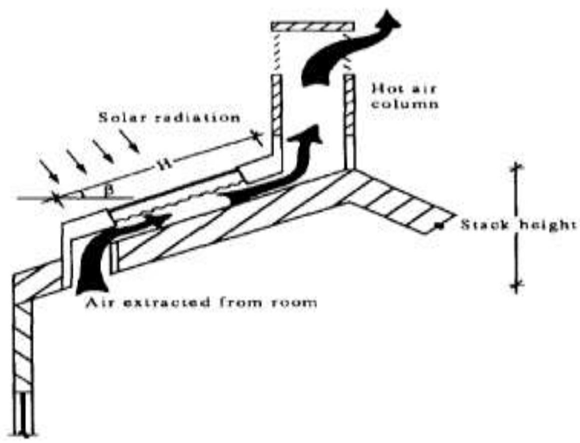


Fig. II System Description of experimental set up by A.K Sharma & N.K Bansal (1989) [20]

A Bouchair (1994) investigates for night ventilation on the ways of improving thermal comfort inside the room by increasing ventilation in the evening. Sun warmed cavity or solar chimney is one of the way for achieving thermal comfort made up of stone, concrete or any other material of high thermal capacity. It can be constructed on an existing building or by modifying a cavity wall just as often used for thermal insulation. Dampers have been provided at the top and bottom of the cavity closed throughout the day for passive heating. To allow ventilation of the room, dampers and window are opened in the evening. Due to the buoyant force, air inside the cavity flows upward and forcing the outside cold air into the room through windows. The heat stored in the walls is taken by the air entering the cavity flowing upward [23]. Krarti and Kreider (1996) performed on an underground air tunnel to determine the energy performance by developing a simplified analytical model. It is assumed that after some days of operation the air tunnel-ground system model approaches periodic and quasi-static behavior. As the heat transfer takes place between ground and air inside the tunnel, a parametric analysis is also conducted to find the air flow rate and the effect of tunnel hydraulic diameter [24]. G. Gan **(1998)** et al investigated on heat exchanger consisting of externally finned sealed pipes filled with a volatile fluid having properties of working temperature range from -40ºC to -100ºC such as methanol commonly known as a heat-pipe heat recovery unit. This unit is having two section evaporator and condenser sections. Evaporator recovers heat from the exhaust air inside the chimney and preheats the incoming air in a supply duct through condenser. Testing of different types of heat-pipe has been done in a two-zone chamber. Two banks of seven pipes with plain fins are employed in one of them. Dampers have been utilized in the chimney and supply duct, a strategy is developed to control the flow rate [25]. Aboul Naga **(1998)** proposed a system for the room to be ventilated which consist of a cooling cavity with uniform cross-section area and system inlet. A solar chimney is inbuilt on inclined roof, system outlet shown in fig.III. The wind cavity flow system is working as a supply system. The outdoor air of relative cooler is captured from the cavity inlet, descends downwards, then supplied inside the room. Due to the pressure difference between the inlet and outlet of the system caused by the available air motion force is partly used in imparting kinetic energy to the wind and rest in overcoming the air flow resistance [26].

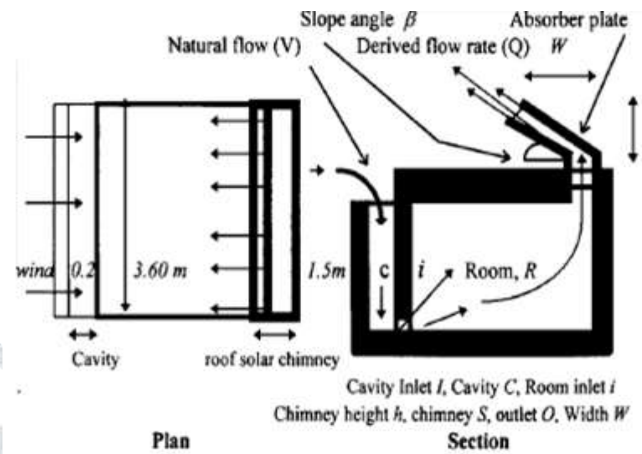


Fig.III Proposed roof solar chimney assisted by cooled cavity for a residential building, Al-Ain, U.A.E. [26]

Aboulnaga and Abdrabboh **(2000)** has performed an experiment to improve night-time ventilation in a building on a combined wall roof solar chimney and reported that when the average solar radiation is 850W/m^2 an air flow rate of 0.81m^3/s can be induced by solar roof chimney alone. When the 258 inclined chimney plates is 0.25m apart the maximum air velocity is about 1.1m/s [27]. Afonso and Oliveira (2000) carried out an experimental analysis of conventional and solar chimney to compare their behavior. They found that with the improvement in indoor air quality there is a significant increase in ventilation rate by utilizing solar chimney [28]. Hirunlabh (2001) et al. explored four different configurations of roof solar collectors under the Thai weather conditions.Using the new configuration of roof solar collectors, the highest volume flow rate of 0.072 m3/s or 0.0206 m3/s per 1m2 of solar chimney can be obtained. [29].

Joseph Khedari **(2002)** et al. suggests that simple photovoltaic (PV) ventilation system enhances the performance of Roof Solar Chimney (RSC). It cannot be appraised as a fully passive because the system uses a DC electric fan to help ventilation, and hence this discourse of the system is none of our concern for this article [30]. Y.J. Dai (2003) performed a parametric analytical study on the enhancement of solar house natural ventilation by utilizing solar chimney and a solid adsorption cooling cavity. Few details are also provided on system sizing. To investigate the effects of a solar chimney on ventilation in a solar house, theoretical analyses will be performed with and without wind effects, using a solar chimney, a cooling cavity, or a solar chimney and cooling cavity combined. The study shows that a solar house equipped with a 2.5m solar chimney can produce an airflow rate of over 150kg/h on a typical day. The ventilation rate is also increased by 20% with the solar adsorption occurring at night. It is expected that the proposed concept is fruitful to be incorporated a stand-alone building or with a cluster of buildings for some favorable climate [31].

K.S Ong and C.C. Chow **(2003)** developed a model which is alike to the Trombe wall except that the wall is assumed to have negligible mass. One side of the chimney is covered with a glass panel with which a channel is formed by the three other walls of the chimney through which naturally rising heated air may pass. The bottom of the wall is uncovered so that the room air may pass through. The surface of the wall which is exposed to the sunlight for absorbing heat is black painted to increase solar radiation absorption [13].

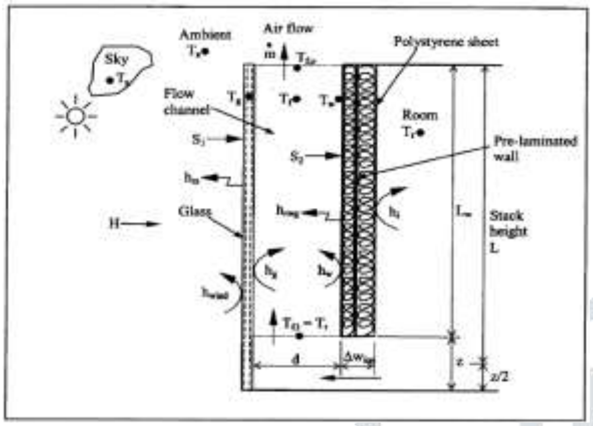


Fig. IV The experimental wall type solar chimney [13].

Drori et al. **(2005)** showed that for ventilating small size homes under a low heat flux condition of 50-60W/m2 solar chimney shows good result. A mobile home was constructed from metallic walls with an inner dimension of 5.95m length, 2.35m width and 2.35m height well insulated and covered from inside and partially by wood from outside [32]. Numerous theoretical and experimental analyses have been performed for a solar chimney sizing. It has been developed that the magnitude of velocity and temperature changes considerably along with the profiles in the gap of a solar chimney throughout a typical day and are the function of ambient air temperature, gap width, wall temperature, insulation rate and the elevation above the inlet duct. The mathematical modeling has been done in order to predict airflow velocity in a solar chimney through predicting the temperature of the absorber, air inflow channel and glass cover. A solar chimney of absorber having a height less than 1m is utilized for the experimental validation of the model. As part of the investigation, three different air gap sizes and sizes of the chimney's inlet opening were taken into account. The flow velocity up to 0.24m/s has been recorded experimentally for the small sized solar chimney which has opened the possibilities of using windows as a solar chimney [33].

J. Mathur & N.K. Bansal **(2006)** et al. performed an experimental analysis on a solar chimney utilized in a room for ventilation to observe the effect on varying the ratio between height of absorber and air gap of solar chimney. According to the study, solar energy can facilitate maximal ventilation rate of 5.6 air changes per hour in a room of 27m3, where height to air gap ratio is 2.83 and solar radiation is 700W/m2 incident on vertical surface [34]. Kaneko **(2006)** et al. has introduced novel idea for an inclined solar chimney to built-in latent heat storage for nocturnal ventilation. The prototype of solar chimney is fabricated and installed on eight storey building with in-built latent heat storage and tested for its thermal performance. The solar collector used in this prototype was made up of aluminium plate and incorporated with sulphate-de-ca-hydrate (Na_2SO_4. $10H_2O$) as a phase change material having an inclination of 45° angle. It has reported the air flow rate of 100-400m^3/h which was not produced by thermal effect only. The flow rate can also be attained by the induced wind [35]. J Mathur **(2006)** performed an experiment on a cubical chamber of size 1m×1m×1m made up of wood. The solar chimney was fitted at the top portion of the chamber with an inclination at an angle of 45°. The set-up of the solar chimney part consists of a solar radiation absorber made up of 1mm thick aluminium sheet. The ordinary black paint was painted on the aluminium sheet for heat absorption. A glass cover of 4mm thickness is used to cover the absorber sheet with an air gap of 0.35m. The chimney inlet covering the entire width of the base chamber was also kept of 0.35m – 1.0m. The inlet and outlet of the chimney was kept equal, the warm air inside the chamber is exhaled out in the atmosphere. A thermocol (EPS) sheet of 2.5cm thickness were used for insulating all exposed side of the base chamber, to reduce the heat transfer with ambient. Similarly, to prevent the heat loss from the back side of the absorber an insulation of 5cm was provided. On one vertical side of the cubical chamber an opening of 0.35m×1m size was provided for suction of air from atmosphere as shown in the figure [36].

D.J Harris **(2007)** et al. discusses the basic operation of solar chimney used in his experiment. Solar radiation moves through glazing and absorbed at the surface of the wall. The air is heated inside the chimney by convection and radiation from the absorber. An air rises upward due to the decrease in density, which is replaced by the air blown from below, i.e. from the attached room. The buoyant force experienced plays a critical role which decides the rate at which air should be drawn through the room, (i.e. dependent upon the temperature difference), the resistance to flow of air through chimney and the resistance to fresh air entry inside the room. The main aim of the solar chimneys are used to provide ventilation for cooling, but when the warm air is directed into the building by using a fan it can also serve for heating the room [14]. Chungloo and Limmechokai **(2007)** studied the effect of solar chimney performed on a test cell considering as an actual room size spraying water over a roof on natural ventilation. The maximum reduction in temperature achieved is 3.5°C when the ambient temperature was of 40°C when a separate chimney is considered, and a maximum reduction in temperature of 6.2°C is recorded for the combined effect of water spraying and solar. According to a previous study, the inlet and outlet temperatures of the solar chimney decrease during the period of high solar radiation and ambient temperature. On the other hand, the difference in temperature increases due to water spraying and consequently the flow rate of air through the chimney. Hence the stack effect on natural ventilation with low rates of Reynolds Number is recommended for future prospects to be carried out [37].
Nouanegue **(2008)** et al. consider the case of mixed ventilation: due to the venturi-effect a negative pressure is created at the outlet of tower which produces forces convection in a tower system and because of buoyancy effect free convection is produced. The dimensionless volume flow rate and Nusselt number were calculated as a function of the dimensionless conductivity of the solid medium, Reynolds number, Rayleigh number and geometric parameters such as exit port size, aspect ratio and wall thickness. The performance of ventilation is very less affected by the wall thickness than parameters from the result [38]. Bassiouny and Koura **(2008)** studies analytically and numerically of space ventilation about the influence of chimney inlet aperture size and width, and predicted the flow pattern inside the chimney as well as inside the room so as to optimize design parameters [39].

S. Punoyani **(2009)** with his team of researchers in Thailand studies experimentally the use of solar chimney in a high rise building. Three storey-building which consist of two small scale model were built. Each storey in building taken into consideration has a dimension of 1.2×1.2×1m. Two different configurations were studied for the solar chimney integrated in the south faced wall of the building. In the first configuration we have only one outlet opening at the third floor and individual opening is provided at each floor, whereas in the second configuration a separate opening for inlet and outlet has been provided at each floor. Solar chimney utilizing first configuration shows better result as compare to second configuration. It was concluded from the result that in order to save energy and environment for hot climatic condition solar chimney can also be employed for providing mechanical ventilation in high rise multi-storey building [40].

Pillai and Agrawal **(2009)** have found a linear relationship between the efficiency of solar collector and the absorptance of the absorber surface for which absorptivity is greater than or equal to 0.8. T Lui in **(2007)** has also proved that the higher absorptivity of absorber surface plays a vital role for efficient solar collector [41]. Researchers Lee and Strands (2009) studied the absorptivity effect on ventilation enhancement and found that there was an increase of about 57% in airflow rate by increasing the solar absorptance of a solar chimney's absorb wall from 0.25 to 1.0. This is due to the fact that with the increase of solar absorptance the surface temperature of the absorber wall increases significantly. Hence in order to maximize the ventilation impact the absorptance for the absorber wall must be higher [42].

M. Maerefat & A.P. Haghighi **(2010)** propose a solar system that mainly consists of two parts: the solar chimney and the earth to air heat exchanger. Among its glass surfaces, the solar chimney has a south-facing glass surface and an absorber wall to capture solar energy. The solar chimney heats up the air inside it by the solar energy and due to the stack effect air flows upward. This results in forcing the outside air to be suck through the cooling pipe [43]. Jalil and Zinah **(2011)** have performed a numerical investigation on a solar chimney for various inclination angles ranging from 30^o to 90^o and varying the thickness of the chimney from 0.1 to 0.2m. The results from the investigation is that the maximum air temperature and maximum air flow rate were 101.7^{o}C and 306.3m^3/h respectively for a heat flux of 500W/^{2} and chimney thickness of 0.2m [40,44]. R. Khanal **(2011)** investigates on enhancing the natural ventilation, while taking different design parameters into consideration for finding optimum design solution. Research indicates that among many parameters, chimney aspect ratio (stack height/air gap width) and ventilation height (height between inlet and outlet apertures), absorber material thermal characteristics, aperture area and chimney tilt angle affect ventilation most [45]. Jalil and Rafah **(2012)** studied numerically for enhancing natural convection in the solar chimney by the effect of induced air flow. The maximum air velocity at the inlet of the tower and the maximum temperature on the ground floor is calculated by examining the solar chimney's performance [46].

A study by Ahmed Abdulnabi Imran (2015) investigated solar chimney parameters numerically for various angle inclination, solar heat flux, and chimney thickness (15, 100 and 150 mm). One solar chimney was installed on the roof of a single room with a volume of 12m^3 as the test bed for the experimental study. The chimney used of size 2m in length, 2m width having three gap thickness of 50, 100 and 150mm. The solar chimney performance is calculated by measuring the glass cover's temperature, the absorbing wall and the velocity and the temperature of induced air. The numerical model shows that; the angle of 60^o is the optimum inclination for chimney to obtain maximum rate of ventilation. The ventilation rate was about 20% higher than 45^o for this inclination. With a solar radiation of 750W/m^2, a surface angle of 60^o, aspect ratio of 13.3, and length of 2m of chimney, the highest rate of ventilation induced using solar energy is found to be 30 air changes per hour for a 12m^3 volume room. At an air gap of 50mm thickness and radiation intensity of 750W/m^2 the maximum air velocity found to be 0.8m/s. Even at the largest gap of 150mm there is no reverse air flow circulation was observed. Without any mechanical assistance, the ventilation and cooling in a natural way (passive) from the induced air stream by a solar chimney [47].

Xinhu Zha **(2017)** investigates the basic form of solar chimney which mainly consist of a dark heat absorbing plate, glass plate, a metal support, a layer of thermal-protective material, a metal blind flange, air inlets and air outlets. The ventilation duct is provided between the heat absorbing plate and the glass plate. The heat absorbing plate and the chimney channels absorbs the solar radiation when it passes through the glass plate, the heat pressing difference is created due to the rise in the temperature of the air in the ventilating duct, which also helps in the air flow.

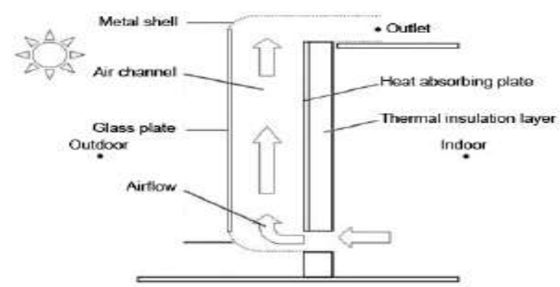


Fig. V Sketch of Solar Chimney [48]

A system consisting of an earth to air heat exchanger and a solar chimney (EAHE-SC) is considered in the present paper as a passive cooling method. A schematic diagram of the passively cooled room is shown in figure. During the daytime with the help of solar energy, both cooling and ventilation can be attained. Hence it is a natural day ventilation technique [48].

X.D. Cheng **(2018)** et al. performed an experimental analysis which shows that there is an increase of about 10.6% in the volumetric air flow rate through the cavity when the height of the inlet is increased from 0.2m to 0.4m, which is a great achievement when it only needs to move air inlet. It is concluded in the paper that always there is a balance between the pressure difference and the air resistance from the room opening [49]. Ahmed A. Serageldin **(2018)** et al. optimizes a solar chimney coupled with an earth to air heat exchanger using the computational fluid dynamics (CFD) ANSYS design exploration tool. A parametric study is shown to maximize the ventilation rate, using eight parameters for solar chimney configuration (width, length, air gap, inclination angle and position) and EAHE design (pipe diameter, inlet position and inlet height). EAHE pipe diameter is the key parameter followed by the chimney height [50].

3. CONCLUSION

In this paper passive ventilation technique being employed to remove the undesirable heat from the building has been discussed. The low energy consumption involved this method leads this technique as an alternative approach to the mechanical ventilation system. A literature review has been presented in this paper on the performance and efficiency of the passive ventilation systems. The review consists of several studies performed by the researchers in the design, performance evaluation and energy consumption in using the solar ventilation system in various applications. The review shows that the operational cost and energy consumption are low in case of using solar ventilation. Since 1990, a remarkable amount of research work has been carried out in the field of solar chimney. The overview of the past work carried out in this field has been discussed and the effect of geometry and inclination angle of solar chimney, night ventilation, earth to air heat exchanger and performance of solar chimney has been presented in this article. It is found that a number of numerical and experimental studies have been carried out in the passive ventilation techniques using solar chimney in past. This review has mainly found that solar chimney as a passive ventilation system requires more concern towards the evaluation of performance.

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