Review of Passive Cooling Methods for Buildings

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Abstract: An energy crisis has become a challenging issue all over the world. More than 40% of energy consumption (or more than that) is due to buildings. People were and are always looking to improve indoor conditions. Cold countries are worried about keeping the space warm whereas hot countries are worried about keeping the space cooler. There has been an exceptional increment in the utilization of air conditioning system, air coolers and fans for cooling the buildings all around the globe. The cooling load requirements of buildings have witnessed a severe energy crisis in developing countries, particularly during summer for the last two decades. Increasing consumption of energy is also one of the reasons and has led to environmental pollution resulting in global warming and ozone layer depletion. To overcome the above-said problem, we have to go with different types of cooling systems. Passive cooling and Active cooling are the two main types of cooling systems. In Active cooling technique mechanical energy in one or other form is used to cool the interior of the building (ex: Air-Conditioning (A/C), Ceiling fans etc.) which requires power source to provide the desired effect, whereas, Passive cooling technique is natural method of cooling buildings is least expensive, and it mainly depends on interaction of building and its surrounding. This paper aims to present a review of different types of Passive cooling technologies to reduce the cooling load on buildings.

1. Introduction

Globally the issue of the Energy crisis is becoming one of the most challenging problems. 40% or more of the consumed energy is because of the buildings [1]. People are and always look for improving the conditions inside their homes. Tropically hot countries are worried to keep their place cool and cold countries wish to keep their places warm.

The characterization of energy that is present worldwide can be done as per the depleting energy resources as well as the rise in the expenses as well as environmental effects, with the demands increasing everyday are also presented. British Petroleum (BP), The “Inter-governmental Panel on Climate Change” (IPCC), and the “International Energy Agency” (IEA) classifies Buildings, Agriculture, Industry, and Transport, as the major energy consumption sectors in the whole world. [2-4].The Working Group III associated with Intergovernmental Panel on Climate Change considers the Industry is the Biggest power-consuming sector, while the Building sector including Residential, Public, and Commercial are the 2nd largest power-consuming sector.

The building sector presently gets the 3rd largest emission of Greenhouse gas, with the CO_2 element associated with 84.5 $kgCO_2$ consumed per GJ on the last stage [5] with reference to energy-related greenhouse gasoline (GHG) emissions. In case such a primary consumption of power keeps on increasing especially in the building sector, where the usage of firewood stoves with low efficiency, and GHG refrigerant fridges, and AC (Air Conditioning), the emission of Green House Gasses will would become second-highest share after the sector of industries [5] spanning from in year 2004 producing 8.6billion ton carbon dioxideto11.1billion ton in 2020 and 14.3 billion tons by 2030 [5]. The energy used by the building sector might basically be caused by 3 primary applications i.e. electric devices (Lighting, Refrigerators, Ovens, Entertainment units and much more preparation, activity), heating water for domestic use, room interior heating or cooling. Cooling down of spaces is normally furnished using the electrical devices all over the world significantly, out of 50, 27 of the largest metropolitan areas of the world were situated to develop nations under hot climates [6] wherein the space cooling is very much inneed. AC units are electrically driven and are mainly used for thermal comfort which requires higher demands of energy. For countries, on developing levels the usage of Air Conditioning results in most of the electricity consumption in the building sectors [6]. With an increase in Air Conditioning usage, the emission of Green House Gasses also increases which particularly depletes gasses and oil [2,3], hence this drives up its hindering and expenses and financial growth [2,3].

In this article, a review has been made on the various methods for the reduction of cooling load on the buildings.

2. Passive Cooling methods - A Review

For reducing the cooling load on the buildings, there are different cooling methods viz. Passive Cooling Methods and Active Cooling Methods.

Design or technological featured formed for providing cooling to the buildings with or without using a minimum amount of energy is known as Passive Cooling [7] these are used for improving the effectiveness of energy [8]. Whenever power consumption occurs, passive cooling methods are small set alongside the consumed cooling compared to active methods of cooling [7,8]. Further, it is often run on energy sources that are highly renewable [8]. Passive techniques of cooling are the most important for building cooling. Successful passive cooling designs used in the buildings require efficient knowledge regarding the patterns of airflow around a building as well as the effect other buildings in the neighborhood have on it. Different types of Passive cooling methods are derived based on the internal gain of heat, transfer of heat in an envelope form along with transfer of heat occurring in outdoor and indoor air mixed of them.

2.1. Internal Heat Gains

2.1.1. Shading. For reducing a direct gain of solar radiation shading is used. It is an effective technique used in reducing the gain of solar radiation to the covering of the building named as shading. Doors with curtain, roofs, and windows walls, all helps in avoiding the excessive gain of solar radiation, where the use of curtains might be porous to provide better air circulation. There is a connection between thermal performance and daylighting for shading devices, hence, the analysis integration has to be performed to include the interactions taking place among various parameters also for attaining optimum outputs. Nonetheless, as per some exceptions, the issue just isn't used during the early phase of design, where some decisions which are critical under a small effect on the economy might results in significant savings of energy throughout the life span of a building. (Clarke 2001)[9].

Li et. al. (2004)[10] studied the daylighting characteristics and usage of energy for the residential flats who face huge obstructions in the sky through computer simulations in Honk Kong. The key parameters they have analyzed for the daylighting performance in daylight factor, as well as Illuminance level terms and they, concluded limits for external obstructions so that you can satisfactorily achieve internal daylighting levels. Ho et. al. (2008) studied illumination from daylight for the sub-tropical classroom, looking for some optimum geometry used as a shading device. Also, analyzed the lighting power required for enhancing the illumination within a classroom.

Poor-quality lighting is the main disadvantage of this technology [11,12]. In this connection combined thermal and lighting analysis has to be carried out. The most important parameters that to be considered at the early stages of optimization are the area of glass, shading properties and control [13-17]. Many researchers have performed a detailed analysis of shading and concluded that on average, the indoor temperature has been reduced by 3^{o}C.

2.1.2. Glazing. Few of the thermal aspects of the glazed surface of the building envelope affects the solar radiation penetrating into an internal space. This convection process is mainly affected by channel dimensions and widths for the outlet and inlet openings, thereby, affecting the overall heating performance. Making usage of double glazing increases the rate of flow to 11-17 percent. Having said that, insulation of the inner surface regarding the storage wall to provide summer cooling helps in avoiding extortionate excessive heating because of south-facing [18].

The selective transparent films signify a fascinating selection for controlling a gain of solar temperature, which is used to deal with façades or windows specifically current structures, to enhance the performance of transparent façades and windows. These films and coatings are nowadays being manufactured by all global companies manufacturing glazing and glasses. This signifies a highly advanced technology which is can be used increasingly in the triple or double-glazing system which improves the performance of windows.

Numerous studies have actually stated a number of characteristics of selective films and coating for the applications of these windows. Roos et al. [18] examined its impact associated with the angle of incidence of radiations from the sun in terms of optical properties of windows controlled by the sun. Nostell [19] conducted a wide experimental campaign on different coatings and presented the results of it, while the three-layer systems optical property on the substrates of glass is measured by Durrani et al. [20].

Many researchers have analyzed the modeling of CFS: “Complex Fenestration Systems” which includes Translucent materials, solar control films, shading devices and multi-layer glass panes. The HT of glazing with multiple layers and the selective coating is modeled by Alvarez et al. [21], although, the pros with respect to cooling and lighting energy consumptions in buildings by making use of films that are controlled by the sun is evaluated by while Li et al. [22].

Another model was developed by Maestre et al. [23] for the optical properties dependent on the angle of glazed coating, even though, Parekh and Laouadi [24,25]came up with CFS based optical models working on the distribution functions of bidirectional optical properties. The present studies by Visser and Bakker [26] reviled a larger utilization of glazing controlled by the sun in EU nations could dodge the emanation of as much as 80million tons of carbon dioxide, that speaks to 25% of the objective built up in 2020 for saving energy by European Commission.

2.2. Heat Transfer through envelope

2.2.1. Phase change materials. PCM is developing innovations that comprise microcapsules made up of a blended wax, paraffin, and other material of low melting point which has a prime objective on a building, which will store the heat which will, in turn, works as a free system for cooling [27-30]. The general principle of Phase Change Materials is to change the phase either Liquid to gas, Solid to Solid, or Solid to Liquid [31-35] which will store the latent heat and release as and when required. The temperature variation of these materials is in a limited range as the stored heat is latent [31-35].

In general, Phase Changing Materials could be linked to all the components and types of building envelopes, however, the characteristics and configurations will have its unique feature for different application areas. Another explained incorporation of Phase Changing Materials in the building was presented by Pasupathy et al. [36] along with many techniques used for containing them to manage thermally in both commercial and residential buildings.

The Phase Change Materials wallboards integration, roof &ceiling, as well as windows are the most common research subjects because of its reasonably more efficient area of heat exchange and much more appropriate to implement among all the PCM applications for buildings.

2.2.1.1. PCM in glass windows. As explained in the before given descriptions about applications of Phase Change Materials, it can be observed that the majority of the applications and studies are aimed at all “opaque” parts of the envelopes of buildings, viz. walls, floors and ceilings. Although it was observed that a “transparent” part in a building envelop such as the windows have a less level of thermal resistance as compared to any other part. There are only a few studies explaining the “PCM filled glass windows” because of the features of Phase Change Materials as well as its implementation which is relatively quite difficult. Ismail et al. [37, 38, 39] performed many experimental and theoretical research on the PCM and composite glass system [37, 38, 39]. Figure 1 demonstrates the experiment performed by them. Mainly there are five parts in the complete system: Tested glasses, thermocouples, electrical pump, PCM tank, and the control system. The feedback system is comprised of an electrical pump, control system components and thermocouple. When some exterior or interior temperatures are monitored by the thermocouples (control system preset), a feedback system would switch the electrical pump on automatically and fill the gap b/w the glasses with a certain PCM liquid from the PCM tank [40]. Ismail et al. have introduced both modes of winter and summer of the test rig of the window filled with Phase Change Material [37, 38, 39].

The well-designed window system with Phase Change Material to be used in winter mode is highly characteristic, where a layer of PCM is solidified completely ahead of the external temperature starting to rise [40]. In a similar manner, a well-designed window system with Phase Change Material for summer works on the feature that a layer of PCM is liquefied completely ahead of the external temperature starting to decrease [38,39].

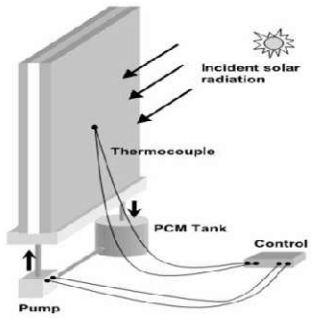

Figure 1. Experimental test rig of Phase Change Material filled glass windows [42].

2.2.1.2. PCM in Wallboards. In general, The PCM is easily integrated with the walls of the building in two ways i.e. "Immersion" and "Attachment". “Attachment” is to attach one or many such materials will integrate into wallboard layers to a wall. In such a case, the Phase Change Materials will not be comprised of the material of the wall but would be integrated by layers enclosed beyond this wall. With the integration of Phase Change Materials to the wallboard in place of the surface of the wall, these are regarded as an indoor element of the whole design work after associating the construction to the building envelopes. In recent days, mass production of wallboards such as Phase Change Material with the integration of Gypsum board and Phase Change Material integrated panels of composites by some typical companies, thereby increasing its efficiency which helps in reducing the cost. Ghoneim et al. [43] carried out a simulation by performing a numerical analysis related to the collector-storage building wall to a completely different medium of thermal storage: ancient concrete, P116-wax, medicinal paraffin, and sodium sulfate decahydrate.

Its simulations as compared to the performances (specifically investigating the Solar Saving Fraction parameter) of varying Trombe walls having a varying thickness of the wall, thermal conductivities, ventilation conditions, Phase Change Material melting temperature as well as ratios of load-collector.

Khalifa et al. [44] came up with a numerical model and worked on simulating the working of 3-thermal storage walls all with different materials: ancient concrete, paraffin wax and $CaCl_2 6H_2O$ hydrated salt in Iraq's hot climatic conditions. Results of these numerical simulations depicts that so as to take care of a person's comfortable zone of temperature a desired minimum thickness of this wall ought to be Eight (8) cm for hydrated salt $CaCl_2$ $6H_2O$, Five (5) cm for paraffin wax, and 20cm in case of ancient concrete, an 8cm thick wall of $CaCl_2 6H_2O$ hydrated salt will have the minimum number of fluctuations in the indoor temperature levels.

"Immersion" is integrating the PCM to the construction materials of the buildings like Concrete, Plaster as well as bricks. There are three different methods for immersing the Phase Changing Materials with the materials used in building construction: micro-encapsulated, direct immersion, and micro-encapsulated Phase Changing Materials.

As per Sharma et al. [45], no such usage of "direct immersion" and "micro-encapsulated PCM" was a success in the commercial market. Presently an effective technique for immersing is the "micro-encapsulated PCM" into the material of building. The main idea behind "micro-encapsulated PCM" in encapsulating the membrane or the polymers where the dimension of every "micro-capsule" generally is just a few mm. Such an effective method of micro-encapsulation of PCM avoids directly immersed PCM or the macro-encapsulated shortages, like the matter of hard maintenance, leakage, shape-distortion, and poor handling.

2.2.1.3. PCM in roof & ceiling. A ceiling system assisted with Phase Changing Materials are used more in building applications because of the easy implementation and installation in building envelope. For realizing the equal approximation of storage capability with the heat gain in space during the daily cycle must be incorporated into this system in a retrofitted and light-weight building. Lehmann and Koschenz [46] came up with another method of ceiling paneling where the ceiling panel is comprised of the gypsum and micro-encapsulated PCM in the mixture. Additionally, the aluminum fins and capillary tubes were used incorporation with the thermal mass for increasing the process of heat transfer. During the occupancy of the day time, the ceiling panel of Phase Changing Materials is exposed directly to all sources of indoor heat and hence works as the heat sink, whereas in the night the heat absorbed is released by cold water circulation in capillary tubes or through night air ventilation.

2.2.2. Passive cooling shelter. A passive cooling Shelter which regulates fluctuation of the outside temperature directly into construction envelope by using various different pipelines sandwiched in the framework (Roof, Walls,& Floor). These kinds of pipelines will contain material whose heat capability is rather high (such as, water), which will be cooled throughout night time because of the radiative cooling [47,48] as well as intern utilized during morning time to decrease the inside temperature [49]. The heating exchangers are used to transfer internal heat to water pipelines [49]. Additionally, there's a thermally extremely stratified water container (with levels at various temperatures) which operates as heating storage wherever cold water has been taken through throughout morning time which would go throughout nighttime [49]. Moreover, this particular method has been usually operated by the electric tools (electric controllers, water pumps, and many more.) which is feed by the renewable power or energy [49], primarily solar photovoltaic [50].

There isn't any correct proof for the usage in some other climatic problems, but, passive cooling shelters have been generally applied to the desert areas where outdoor temperature is very high with low humidity which ranges from 40^{o}C to 58^{o}C& capability to work with no power & intern attaining interior heat 20^{o}C under outdoor temperature [50]. So far as power usage 100m^2 passive cooling shelter along with the average of(twelve) 12 tubes for every single transversal meter will consume 10-500 W [51,52] which purely depends upon Design and Equipment [50].

Recently many researchers having to work towards its usage of severe hot dry conditions, particularly for the telecommunication amenities [53, 54, 55].

2.2.3. Heat Sinks. The heat sink has been the method of heat loss in which heating temperature gained will be driven into the sink utilized as high heat releaser primarily by the convection (indoor air to the pipeline) following that by the conduction (pipeline to the sink). The main difference among passive cooling shelters along with heat sinks has been: The heat sinks use just one cycle road & there's absolutely no heating storage such as Open cycle.

The heat sink be, such as, a tremendous water body [56,57], masonry [58,59], the ground [60,61], PCM [62], & perhaps (ELTs) end-of-life tires [63], in which usually the heat has been driven to throughout daytime after which launched to the area at nighttime.

The weather problems of usage have been varied so long as the structure has cooling necessities. Moreover, to allow it to be extra effective, the technique has analyzed often with the assistance of the heat exchanger methods by foremost heat coming from inside to heat up sink, whereas driving a much cooler material, such as clean water, out of heat sink [64,65].

2.2.4. Building thermal capacity. Thermal capacity and perhaps thermal mass describes the capability of the construction framework to possibly engross a lot of high heat through the day so as to release them throughout nighttime [66, 67]. With this particular thermal inertia, unexpected interior climate modifications have been stayed away from [68, 69].

This technique has been suggested once the outdoor circumstances demonstrate a low distant relative humidity (hot dry circumstances) [70], in which outdoor heat is likely to act with wide variations than warm humid situations [71].

2.2.5. Radiant heat barriers. Radiant heat barriers have been utilized to stay away from heat gain because of the solar radiation [72, 73]. These radiant heat obstacles include various components situated in the outside facade of the building envelope that won't let the solar radiation to successfully pass through [74]. Reflectivity has been the property that mirrors the solar radiation [75]. It differs from zero to one, & inside a color, the assortment has been calibrated among the measurement associated with white (total reflection) as well as black box standard (zero reflection) with the wavelength spectrum of the visible light [76]. Thus, pragmatic expertise in addition to the scientific analyses has discovered it's better to get colors that are light instead of dark ones [77].

Besides creating color, there will be the number of other functions that could mirror the radiant heat, particularly on roofs & albeit the qualities have not extraordinary of the roofs, the most typical cases [78, 79] have been presented by the building components.

2.3. Heat Transfer between Indoor and the outdoor air

2.3.1. Natural Ventilation. Natural Ventilation was among probably the most essential passive cooling methods. Usually talking, the environment flow of inside locations may additionally be required to complement the necessary crucial oxygen quality levels in addition to the airflow within interior space. In many of the older buildings, the infiltration amounts were giving a substantial volume of airflow, while any additional basic need for quality atmosphere continues to be attained by opening the home windows.

The breakthroughs in the architecture that is modern, as well as energy-conscious designs of the structure, have decreased air infiltration to the minimal, in the effort to bring down its effect on the cooling and even warming load. Especially in the building of large glass business structures, that won't in a place to start the windows that has, even more, eliminating the chance of utilizing organic ventilation giving abundant oxygen to the interior areas.

2.3.1.1. Wind-driven cross ventilation. Wind-driven cross-ventilation happens through ventilation openings on reverse sides of the confined room. Figure 2 reveals the representation of the cross air flow serving multi-storied structure. To guarantee enough ventilation airflow generally, there ought to be a variation of wind strain b/w the outlet as well as inlet openings & least inner resistance. Awbi [80] have examined the motion of air along with the distribution of Carbon-dioxide in a ventilated atrium as well as workplace room by the Numerical outcomes as well as tactic discloses that all-natural ventilation has been effective at obtaining appropriate Carbon-dioxide level.

Raja et al. [81] have performed research in Oxford & Aberdeen, the UK on the thermal comfort of normally ventilated business buildings as well as their experiments have been concentrated to discover the result in changing the indoor winter factors. They've realized that the cross-ventilation with the command settings plays a tremendous part in decreasing the inside temperature.

Sinha et al. [82] mathematically assessed room air atmosphere division with and maybe with no buoyancy consequences for a various outlet or inlet alignments for the cross-ventilated rooms. The ventilation qualities of an area with various opening alignments were studied by Ayad [83]. The model has been confirmed by evaluating the results of constant 2-dimensional flows near much long square cylinder submerged in an atmospheric boundary level with experimental standards. This kind of analysis is considered as an orientation to the model, the computational domain name just for the atmospheric airflow around the model room.

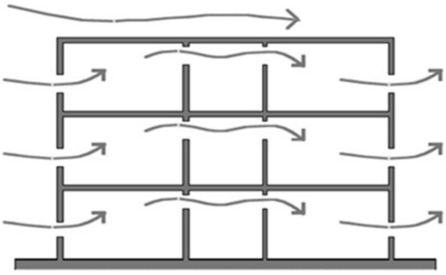

Figure 2. The line diagram of wind driven cross-ventilation [7]

2.3.1.2. Buoyancy-driven stack ventilation. Displacement ventilation and Buoyancy-driven stack ventilation functions on the density variations to push the cool outside air within the room at lower ventilation exhausts as well as openings. The stack ventilation in multi-storied development has been shown in Figure 3. To produce adequate buoyant forces to get the flow, chimney or maybe atrium has been utilized. Nevertheless, even minimum wind which will be the pressure divisions on the building envelope which will even act to get the airflow.

Displacements were compared by Seppanen et al. [84]along with standard mixing ventilation systems in the business structures in the US, by utilizing DOE 2.1C structure simulation application or program. The research study assessed the south, north, along with primary zones of structures in 4 symbolic US environments. The evaluation outcomes disclose, in common displacement methods yielded better air quality, as well as winter or the thermal comfort in comparison with classical mixing systems, functioned with the re-circulation.

Mundt [85] evidenced in an area with the DV process, an individual could be subjected to quality airflow that is good in the breathing zone, even when the particular zone had been in the contaminated coating. The convective plume around the body broke from contaminated levels, moreover really quick improved the local ventilation success or efficiency. The displacement ventilation served as the demand-controlled program for the air that is clean coming from the lower part of the room.

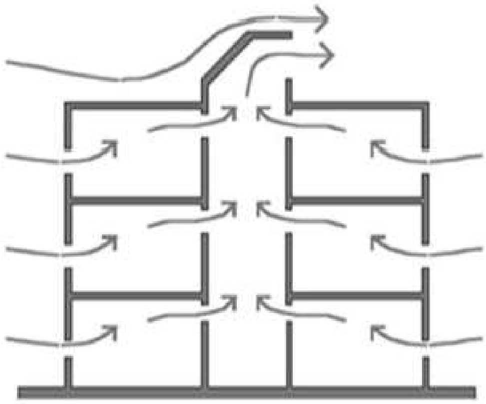

Figure 3. The line diagram of buoyancy driven stack ventilation[7]

Gan & Riffat [86] examined the functionality of the glazed solar chimney for the retrieval of heat in normally ventilated structures applying the Computational Fluid Dynamics method. The Computational Fluid Dynamics method had been authenticated with regard to the experimental information from the literature as well as a discovered fit that is excellent in between the experimental as well as numerical, it's expected that ventilation fee has been discovered to rise with the heat gain as well as chimney wall temperature.

Mundt [87] assessed particle transportation as well as ventilation effectiveness with non-buoyant pollutant energy resources in the displacement ventilated room. Zamora & Kaiser [88] research about a diverse buoyancy wind-driven induced flow in the solar chimney for creating ventilation mathematically, as well as the numerical outcomes have been accessible for different details of interest.

2.3.2. Evaporative cooling. Evaporative cooling has been a method that employs the outcome of evaporation as the natural heat dissipater. Sensible heat coming from the atmosphere has been engrossed to be utilized as latent heat needed to become dry out the water. Sensible heat immersed depends upon water quantity which may be soaked.

Evaporative cooling has been an age-old procedure, having the beginning of some 1000 years back, in old Persia & Egypt. Contemporary evaporative coolers have been based upon the models designed in the first 1900s within the US. Amer [89] has discovered that among several passive cooling methods, the evaporative cooling yielded an outstanding cooling effect, accompanied by solar smokestack that tapered internal air temperature by 9.6°C & 8.5°C, correspondingly.

Nagano &Wanphen [90] assessed the achievement of roof resources on the impact of evaporative cooling as well as obtained that, as compared to the mortar concrete, the siliceous shale can reduce the top surface heat at approximately 8.63°C.

Erens, as well as Dreyer [91] & San Jose Alonso et al. [92] defined, in direct evaporative cooling (IEC), offer power expense that is very low for the air conditioning.

Mehdi &Joudi [93] investigated the use of IEC, to offer the variable cool ton of creating in Iraq.

Raman et. al. [94] created a solar air flow heater for the solar submissive layouts that will collaborate with the evaporation for the summertime cooling.

Numerous varieties of heating exchangers that make use of just the fan as well as water pumping energy had been analyzed hypothetically along with conventionally by different scientists for IEC applications. These experiments have been summarized as mentioned below:

Ren & Yang [95] created a theoretical model for coupled heat as well as the mass transfer tasks beneath existent working problems, with the parallel counter flow plans. They thought many consequences of spray water enthalpy, spray water evaporation as well as spray water temperature across the heat exchanger surface area in the prototype.

Jian Sun et. al. [96] has created as well as established a two-stage evaporative cooling process comprising of the plate heat exchanger, & also found the functionality of 2 phase cooling had been discovered to be 1.1 - 1.2 times over that of single evaporative system.

Heidarinejad & Bozorgmehr [97] functionality of 2 phase evaporative cool devices tried underneath different outside environmental factors have been studied..

2.3.3. Ground cooling. The idea of terrain cooling has been dependent on the dissipation of the high heat on the soil from the structure that, throughout the winter season the heat is going to be cheaper compared to the exterior air. This particular dissipation could be accomplished possibly by the immediate communication associated with a crucial part of creating an envelope with ground & even by injecting air underground into the structure by the way of earth-to-air heat temperature exchanger. A constructing exchanges the heat with earth by radiation, conduction, as well as convection.

For a regular structure, the primary mechanism has been convection, because most of the structure has been in touch with the surrounding air. After than comes radiation as well as lastly conduction, because the area of the structure in exposure to the soil has been definitely the littlest. The concept of terrain cooling by immediate communication has been increasing conductive heat exchange.

The construction temperature drops since the soil has been at the reduced temperature compared to the environment throughout cooling time. Carnody et al. [98] have clarified that earth contact structures have benefits associated not just to their power efficiency, however additionally to the visual effect aesthetics, upkeep of the surface wide open areas, environmental advantages, as well as noise vibration management along with safety.

Tzaferis et. al. [99] have examined different mathematical versions to learn the flow along with thermal attributes of the heat transfer solution, that distributed using a heat exchanger from earth to air ,without thinking about the thermal capacity of the planet, & also compared with outcomes from each one of that designs. The replacements for ground loop heat exchanger design have been reviewed by Rafferty & Kavanaugh [100].

3. Conclusion

The emerging idea of power-efficient structures has focused many researchers to work towards the reduction of cooling load on the buildings by using passive cooling techniques. In this particular paper, different passive cooling techniques that may be put on to building have been examined. Proper care should be taken for choosing the passive cooling method adopted as the passive cooling methods are climate-specific. The climate at different locations will be varying like Dry, Hot, Warm, Sunny, Cold, and Humid conditions.

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