7. Passive down draft evaporative cooling

Passive down draft evaporative cooling is a technique that has been used for many centuries in parts of the middle east, notably Iran and Turkey. In this tradition, wind catchers guide outside air over water filled porous pots, inducing evaporation and bringing about a significant drop in temperature before the air enters the interiors. The most common contemporary application of evaporative cooling is what is popularly known as the desert cooler or swamp cooler. Swamp cooler is a perforated box with wet pads on three sides through which outside air drawn by means of an electric fan. The air introduced into the interior space may only be cooled to above 3-6 ^{0}C above the ambient wet bulb temperature, so that large quantities of air are required to achieve thermal comfort, if the ambient humidity is fairly low.

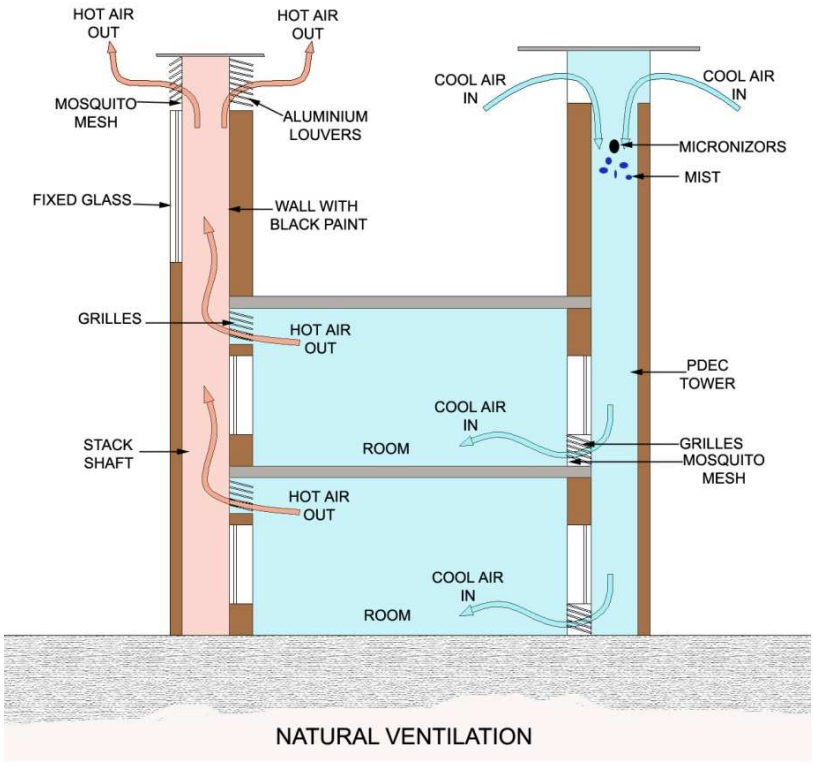
7.1

Where summers in places like Hyderabad are hot and dry with a mean average daytime temperature of 35 ^{0}C and relative humidity of 20-25%. Therefore the design for the building could incorporate an evaporative cooling system. The proposed system comprises of a down draft evaporative cooling tower to provide cooling. The fine drops of water will be sprayed vertically downwards with the help of mirconisers.

The cooling tower capitalizes on the vertical flows generated by thermal conduction: the cooled air, both denser and moister than its surroundings, tends to sink and draw an ambient air in its wake. The rate of air exiting the down draft tower, then, is ideally controlled by the temperature differential between the cooler air inside the tower and warmer outdoor air. Such a thermosiphonic process is based on free convection which occurs in the presence of local thermal imbalance, which subsequent differences in air density leading to the movement of air from a zone of high pressure to one of lower pressure. The thermal force driving the air through an evaporative cool tower is created by the introduction of water spray at the top of the tower. The magnitude of the thermosiphonic force thus depends on the temperature difference between the air at the inlet at the top of tower and the outlet at the bottom. The temperature difference is greatest if the ambient air is warm and very dry and when enough water is added to the airflow to produce saturation condition throughout the length of the tower.

A. Passive downdraft evaporative cooling with stack driven ventilation

The cool air is supplied to the occupant space using passive down draft shaft with the help of mist (micronisers) and the stale air is exhausted using stack ventilation system as shown in the picture. Complete natural cooling and ventilation except the energy required for misting. Consumes 10% of the energy compared to conventional system and can maintain temperature of 28 ^{0}C in summer. This system is well suited for hot and dry climate.

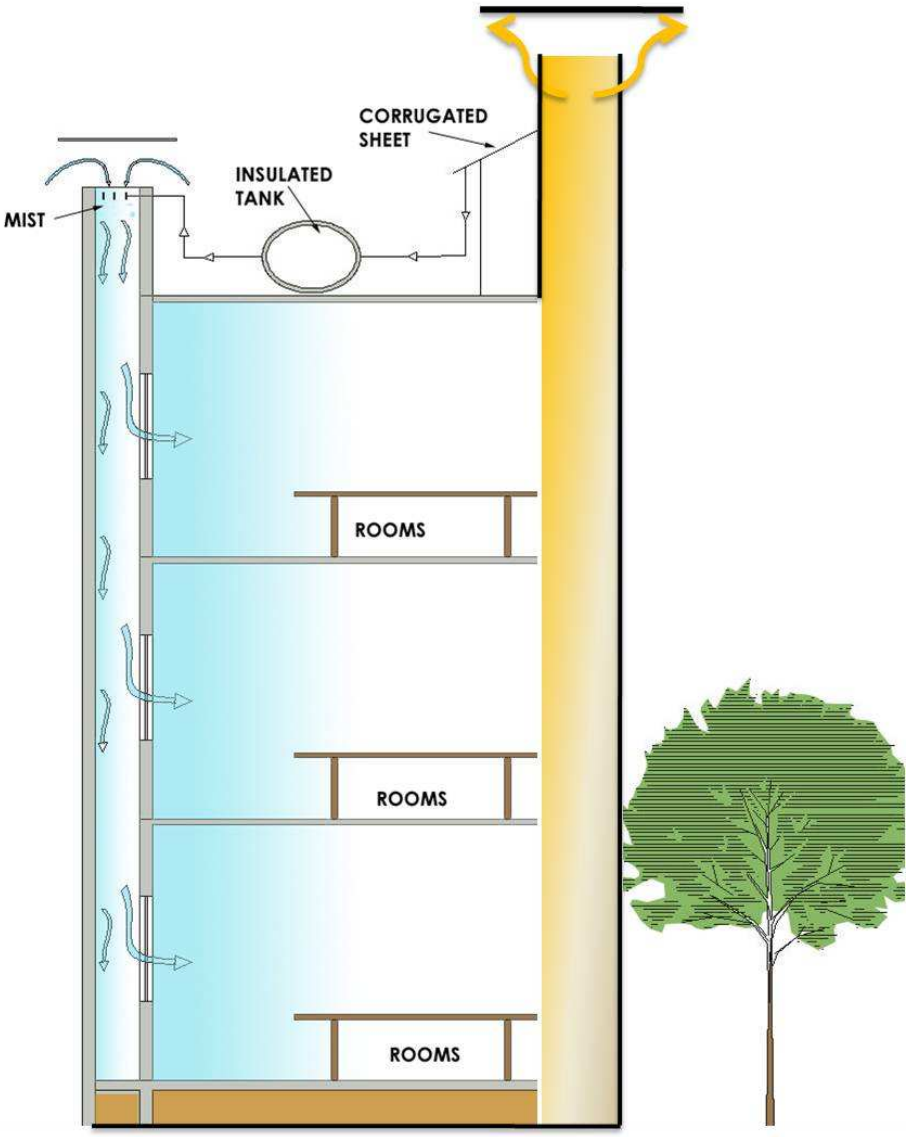


7.A.1

B. Stack effect and Passive Downdraft Evaporative Cooling (PDEC) with night sky cooling

The night sky cooled water is stored in the thermal storage tank and is used for PDEC tower in day time. This systems suits very well for hot and dry climate. It is possible to achieve water temperature of 16 ^{0}C through night sky cooling in Hyderabad kind (hot and dry) of climate. The cooled water in the thermal storage tank is used for producing mist in the cool tower.

With this system it is possible to achieve 26 ^{0}C in peak summer.



7. B.1