

COMFORT COOLING
TOWARDS A GREEN FUTURE
BY

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DESIGN GOALS

- HIGH LEVEL OF COMFORT.
- DUST PROOFING THE BUILDINGS.
- COST EFFECTIVE SYSTEM SOLUTIONS.
- MINIMUM ENERGY CONSUMPTION.
- ECO FRIENDLY DESIGNS.
- ACHIEVING ACCEPTABLE LEVEL OF COMFORT WITHOUT CONVENTIONAL AIR-CONDITIONING.

CONCEPT OF COMFORT COOLING

COMFORT ZONE AS DEFINED BY ASHRAE:

	<u>AIR CONDITIONING</u>	<u>COMFORT COOLING</u>
1. Temperature	22 C ± 2 C	26 C - 29 C
2. Relative Humidity	Below 60 %	Up to 60 %
3. Air Movement	50 to 100 FPM (0.75 to 1.5 m/sec)	Max. 40 FPM (Max. 0.2 m/sec)
4. Comfort Cooling Based on Displacement Ventilation		

DEVELOPING THE CONCEPT

- DESIGN THE BUILDING TO MINIMISE COOLING NEEDS.
- ADD INSULATION / SEALED WINDOWS WITH SINGLE / DOUBLE GLASS.
- FOCUS ON REDUCING:-
 - ❖ ENVIRONMENTAL DAMAGE
 - ❖ ENERGY CONSUMPTION
 - ❖ WATER CONSUMPTION
- MAXIMUM COMFORT WITHOUT REFRIGERANT EXCEPT IN MONSOON.
- ADOPTING INNOVATIVE TECHNOLOGIES TO REDUCE AIR FLOW.

RESULTANT PROCESS FOR COMFORT COOLING

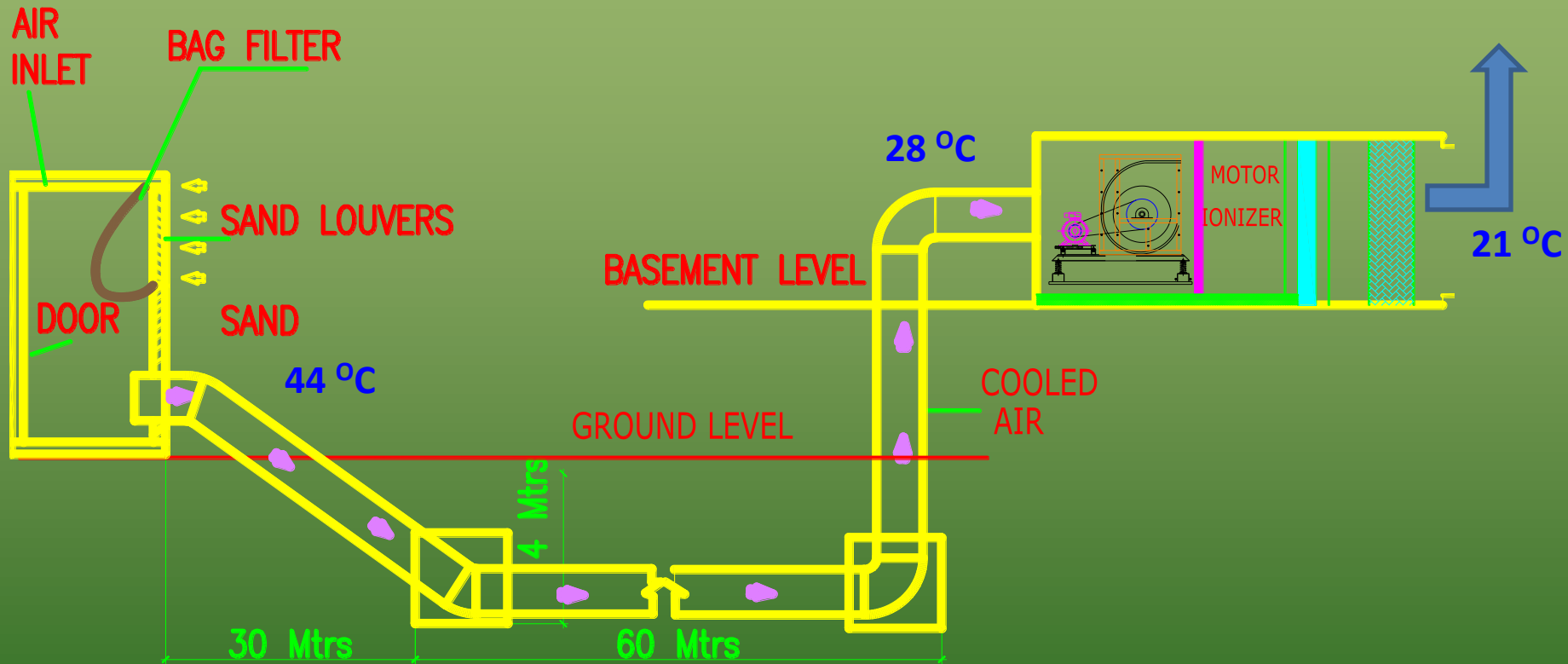
A COMBINATION OF:

- **EARTH AIR TUNNEL.**
- **EFFICIENT EVAPORATION COOLING.**
- **AIR DISTRIBUTION USING DISPLACEMENT VENTILATION.**
- **SYSTEM CAPABLE OF PROVIDING 26 °C TEMP. INSIDE WITH OUTSIDE TEMP. AROUND 44 °C.**
- **USE OF CHILLER WITH CFC FREE REFRIGERANT TO DEHUMIDIFY AIR IN MONSOON.**

METHODOLOGY (COMFORT COOLING)

- 60 TO 90 M EARTH AIR TUNNEL (EAT).
- TO COOL AIR DOWN TO 20 / 30 °C FROM UP TO 46 °C.
- EVAPORATIVE UNIT – TO REDUCE TEMP. TO 20 °C / 21 °C.
- SUFFICIENT AIR FLOW WITH 8 AIR CHANGES TO ACHIEVE INSIDE TEMP. OF 26 / 27 °C.
- COMFORT POSSIBLE DUE TO USE OF DISPLACEMENT VENTILATION, WHERE ALL AVAILABLE AIR FLOW MOVES OVER HEAT SOURCES – PEOPLE - EQUIPMENT.
- VARIABLE FREQUENCY DRIVE TO ADJUST AIRFLOW AS PER REQUIREMENT.

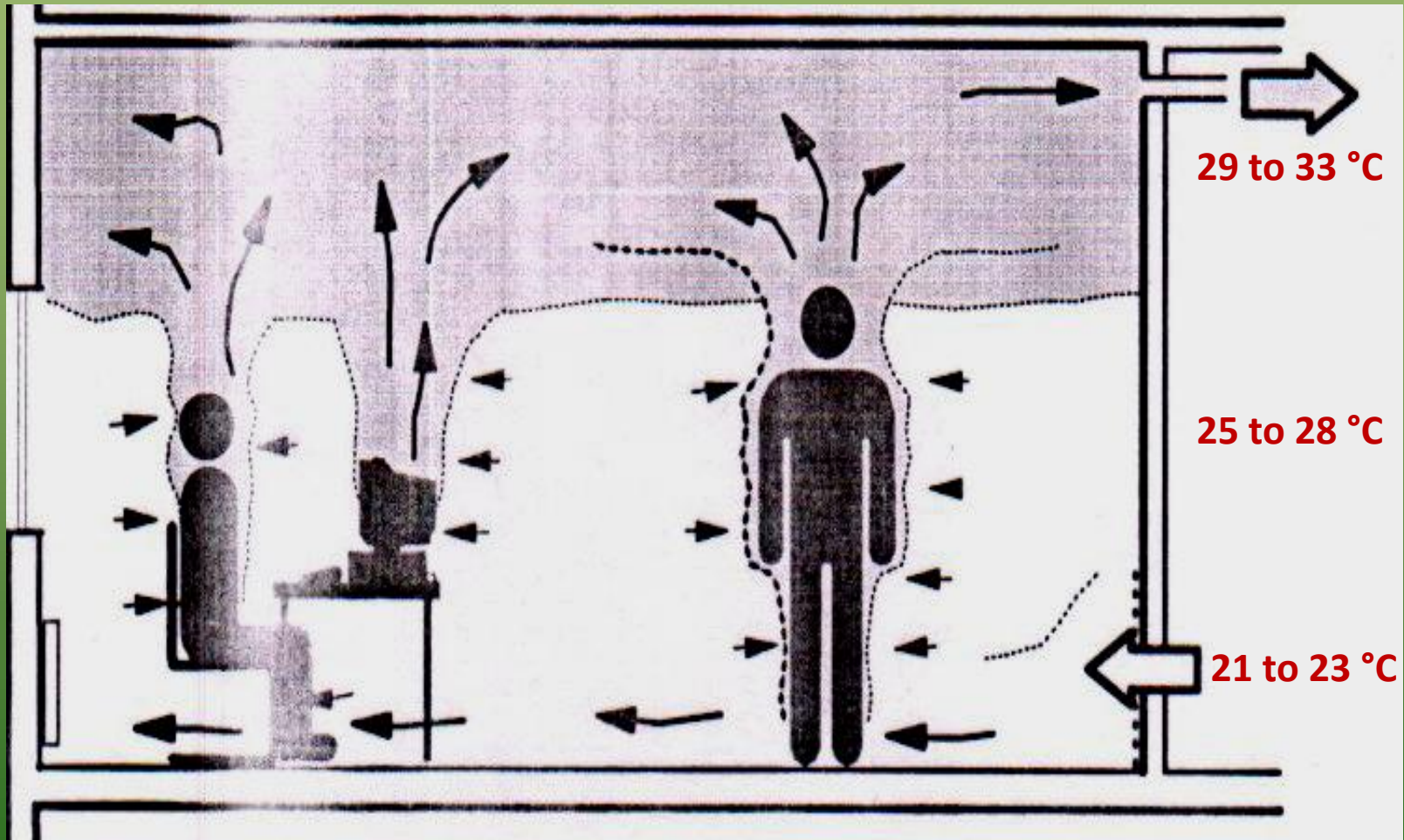
SYSTEM DIAGRAM COMFORT COOLING



TEMP. OF EARTH REMAINS CONSTANT AT APPROX. 4 METERS.

HENCE – COOLING AIR IN SUMMER & HEATING AIR IN WINTER.

AIR PATTERN OF DISPLACEMENT VENTILATION



COLD AIR CAN BE SEEN RISING OVER PEOPLE & COMPUTER

BENEFITS

- **EAT REDUCES WATER CONSUMPTION BY 50%.**
- **AVOIDS ADDITION OF MOISTURE DUE TO EVAPORATION**
- **REDUCES OPERATING ENERGY BY 60% COMPARED TO AIR-CONDITIONING SYSTEM.**
- **REDUCED ADDITION OF HEAT & MOISTURE TO ENVIRONMENT AS REFRIGERATION USED FOR 2 MONTHS ONLY.**
- **SUPERIOR INDOOR AIR QUALITY DUE TO 100% FRESH AIR.**
- **CAPITAL COST OF SYSTEM – SAME AS A.C.**
- **OPERATING COST – ONLY 40% OF A.C.**

CASE HISTORY

- **NIIT UNIVERSITY – NEEMRANA, RAJASTHAN**
- **AREA CONDITIONS**
 - TWO WINGS OF ACADEMIC BLOCK
 - ONE NINE STORY HOSTEL BLOCK
- **EQUIPMENT INVOLVED:-**
 - ❖ **ACADEMIC BLOCK – 8 NOS. EARTH AIR TUNNELS AND 8 NOS. AIR HANDLING UNITS TOTALING – 1,20,000 CFM.**
 - ❖ **HOSTEL BLOCK – 5 NOS. EARTH AIR TUNNELS AND 5 NOS. AIR HANDLING UNITS TOTALING – 75,000 CFM.**
 - ❖ **COMMON – TWO COMMON CHILLERS FOR MONSOON TOTALLING 200 TR.**
 - ❖ **BMS TO OPERATE THE SYSTEM AND COLLECT VALUE DATA ON SYSTEM PERFORMANCE**
- **OPERATING COST – 40% COMPARED TO A.C.**
- **RESULT – INSIDE TEMP. NOT EXCEEDING 27 °C EXCEPT IN MONSOON.**

THANK YOU