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A STUDY ON ENERGY EFFICIENT BUILDINGS

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ABSTRACT

Recent research shows that 20-30% of building energy consumption can be saved through optimized operation and management without changing the building structure and the hardware configuration of the energy supply system. Therefore, there is a huge potential for building energy savings through efficient operation. some advance technology like advance window &shading technology modified atmosphere insulation, cool roofs ,advance rain water harvesting and building orientation The objective of this report to minimize the electricity bill and maximize is the use of natural resource in buildings. In this paper we just adopted the advance techniques from that we can minimize electricity. It is very important to utilize all natural resource and optimize the electricity energy. It shows that simple way to achieve energy efficient buildings

Key Words: - modified atmosphere insulation (MAI), window-to-wall area ratio (WWR)

I.INTRDUCTION

Over the years, electricity use has increased significantly in the commercial sector. Globally, building sector is responsible for 40 per cent energy use. The annual energy consumption in the commercial buildings in India is in excess of 200 kWh per square meter per year. Air-conditioning and lighting are the two most energy consuming end-use applications within a building. This has led the Government of India to include them as ‘designated consumers’ under the Energy Conservation Act (2001). ‘Designated consumers’ as identified by BEE are energy-intensive industries or similar establishments recognized under the EC Act (2001). Buildings having connected load of 100 kW and above or contract demand of 120 kVA and above are defined as Commercial buildings (as per amendment of the Energy Conservation Act 2001 in the year 2010).The building industry alone is also one of the biggest emitter of GHG in India. Electricity consumption in the building sector in India is 7 per Cent of the country’s total electricity consumption. In the building sector, commercial building space accounts for 33 per cent. The building sector is growing at 8–10 per cent annually.

Lack of awareness of energy savings opportunities**:** There were no energy use baselines for most building types. Building designers and owners are unaware of energy-efficiency opportunities and techniques. Information on energy-saving potential in buildings is also not available. Building audit methodologies need to be improved.

1.1 Objective and purpose

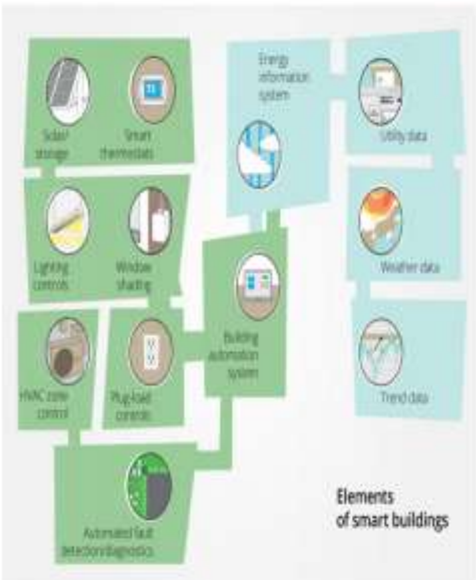
1.1.1 Problem statement

- Project growth rate in India building energy use from 2005 to 2030,where 50-60% due to HVAC and 20-30% due to lighting energy.
- Achieving ultra –low energy goals will depends on managing the significant loads that occur through and leveraging daylight to offset lighting energy use .
- Mission to develop low -cost ,high-performance advanced insulation materials by evaluating a new modified atmosphere insulation (MAI) technology that yields the performance of vacuum insulation panels but at low cost
- Awareness of use of simple method to construct energy efficient homes

1.1.2Project objective

- To identify, develop, and promote the use of energy –efficient window and shading technologies that is pragmatic, cost effective, and can be broadly and rapidly deployed in residential and commercial buildings.
- Determination of thermal performance as function of temperature, pressure of insulation materials used in buildi

II. METHODOLOGY



1. Principles of good orientation
2. Advanced window and shading Technologies
3. Modified Atmosphere insulation
4. Energy efficient roofs

III. EXPERIMENTAL STUDIES

3.1 Principal of good orientation

Orientation is the positioning of a building in relation to seasonal variations in the sun's path as well as prevailing wind patterns. Good orientation can increase the energy efficiency of your home, making it more comfortable to live in and cheaper to run.

Good orientation, combined with other energy efficiency features, can reduce or even eliminate the need for auxiliary heating and cooling, resulting in lower energy bills, reduced greenhouse gas emissions and improved comfort. It takes account of summer and winter variations in the sun's path as well as the direction and type of winds, such as cooling breezes.

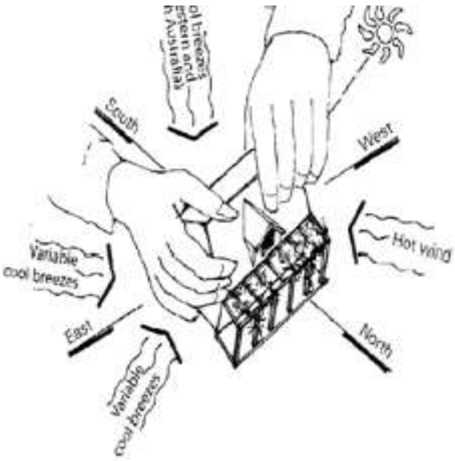


FIG NO 3.1

Ideally, choose a site or home with good orientation for your climatic and regional conditions and build or renovate to maximise the site's potential for passive heating and passive cooling, adjusting the focus on each to suit the climate. For those sites that are not ideally orientated, there are strategies for overcoming some of the challenges.

In hot humid climates and hot dry climates with no winter heating requirements, aim to exclude direct sun by using trees and adjoining buildings to shade every façade year round while capturing and funnelling cooling breezes

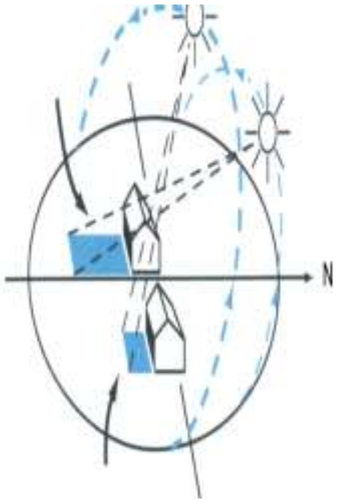
When deciding the best orientation for your home, bear in mind that the climate is warming, and hotter summers with more extreme heat waves will become the norm during its life span. While passive solar heating is still very desirable in climates that require heating, the priority will gradually shift from heating to cooling.

Additional attention to shading of windows and walls (particularly west facing) and exposure to cool breezes and other forms of natural cooling is required in all climate zones.

In all other climates a combination of passive solar heating and passive cooling is desirable. The optimum balance between capturing sunlight (solar access) and capturing cooling breezes is determined by heating and cooling needs

3.1.1Orientation for passive heating

Sun movement from high angle in summer to low angle in winter



3.1.1Average daily solar radiation on vertical surfaces

Orientation for passive heating is about using the sun as a source of free home heating by letting winter sun in and keeping unwanted summer sun out — desirable in the majority of homes. It can be done with relative ease on northern elevations by using horizontal shading devices to exclude high angle summer sun and admit low angle winter sun.

Solar access' is the term used to describe the amount of useful sunshine striking glass in the living spaces of a home. The desired amount of solar access varies with climate.

A north-facing slope increases the potential for access to northern sun and is ideal for higher housing densities. A south-facing slope increases the potential for overshadowing. Your design for solar access should not compromise that of your neighbours.

At subdivision level, smaller individual lots are ideally located on north-facing slopes where they still receive solar access at increased densities.

South-facing slopes are often better suited to medium density where party walls can be designed to provide thermal buffers and smaller floor areas can be solar heated with carefully designed and shaded east or west-facing windows using advanced glazing

North–south sites on the north side of the street allow north-facing living areas and gardens to be located at the rear of the house for privacy.

North–south sites on the south side of the street should be wide enough to accommodate an entry at the front as well as private north-facing living areas. Set the house back to accommodate a north-facing garden and consider creating a private outdoor living courtyard with plantings or even a garage on the northern boundary where planning permits.

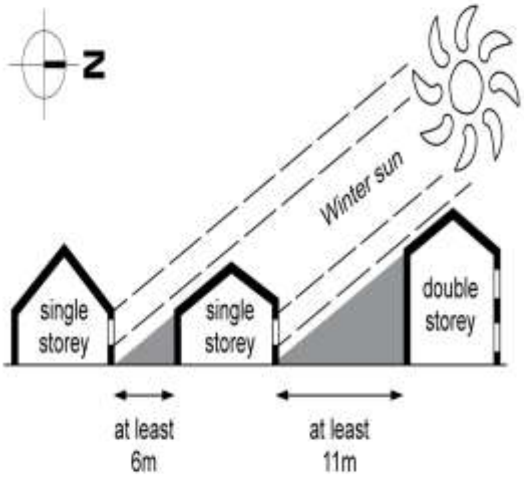


Fig NO 3.1.1

3.1.2 The house

The ideal orientation for living areas is within the range 15°W–20°E of true or 'solar' north (although 20°W–30°E of true north is considered acceptable). It allows standard eaves overhangs to admit winter sun to heat the building and exclude summer sun with no effort from the occupants and no additional cost.

Poor orientation can exclude winter sun as well as cause overheating in summer by allowing low angle east or west sun to strike glass surfaces,

Creating a greenhouse effect where it's not required. Choose a house that has good orientation or can be easily adapted for better orientation.

Build close to the south boundary to maximise sunny, north-facing outdoor living areas and protect solar access but avoid compromising the solar access of neighbours. Choose a home with living spaces that have good access to winter sun

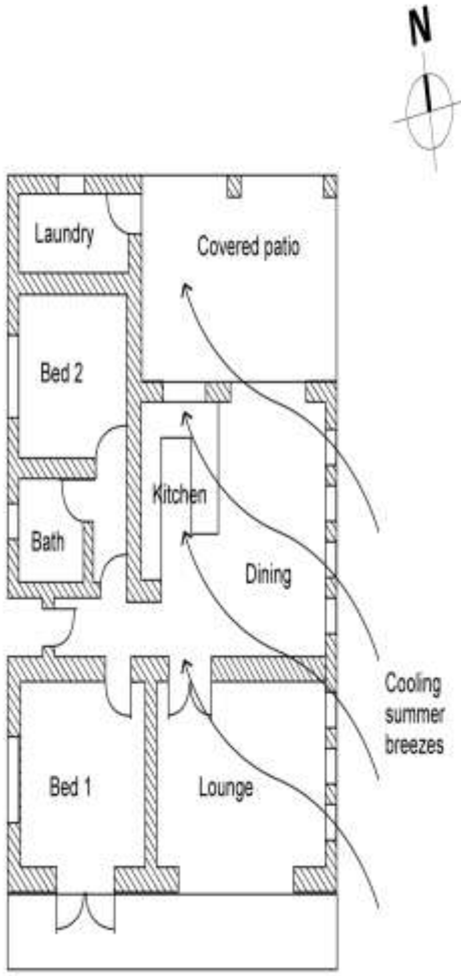
Detailed information than the following brief overview, read buying a home off the plan.

Select a design that allows daytime living areas to face between 15° west of north and 30° east of north on your site. Most project home companies will mirror or flip a design to suit your needs at no extra cost. East is best in warmer climates and west in cooler climates.

Turn north-facing verandas into pergolas (including those with adjustable blades) by replacing roofing material such as tiles or metal with slats or louvers, particularly over window areas.

Shade east and west-facing glass by adding or relocating shade structures

Including verandas and deep covered balconies. Reduce the amount of south, east and especially west-facing glazing, or relocate some to north-facing walls. Select smaller windows on south, east and west-facing walls to aid cross-ventilation.



3.2Advanced window and shading Technologies

3.2.1Windows

Flush-mounted, non-operable windows were modelled in the exterior wall of each perimeter zone office. Five window sizes were modelled with a fenestration window-to-wall area ratio (WWR) (which includes the area of the whole window with frame), of 0.0, 0.15, 0.30, 0.45, and 0.60, where the wall area was defined as the floor-to-floor exterior wall area and the floor-to-floor height was 3.66 m (12 ft). Note, the ASHRAE Standard 90.1-1999 uses this definition; however in previous research, WWR was based on the glazed window area Figure gives the position of the window in the window wall as seen from the exterior. Window position can influence the distribution of heat flux to interior room surfaces and the distribution of daylight within the room. The head

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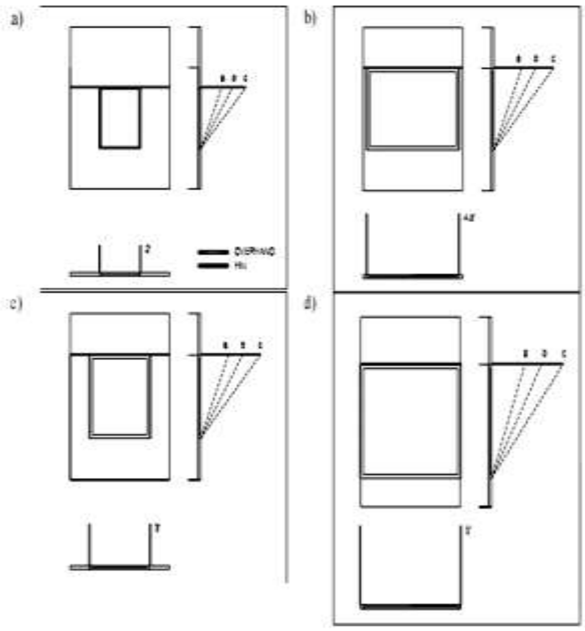
height of the framed window was set flush with the ceiling at 2.74 m (9 ft) for all glazing areas except WWR=0.15.



Elevation view of the window wall for window-to-wall ratios (WWR)
a) 0.15 b) 0.30 c) 0.45 and d) 0.60 (top to bottom) Sections through the overhang and fin are given to the right of each elevation.

Wwr	**Window height ft**	**Window width ft**	**Windw sill height ft**	**Area window ft^2**	**Frame width ft**	**Area glass ft^2**	**Wwr**
0.0	0	0.0	0.0	0.0	0.00	0.0	0.0
0.15	4.5	4.0	3.0	18	1.25	16.27	0.14
0.30	6.0	6.0	3.0	36	3.00	30.25	0.25
0.45	6.0	9.0	3.0	54	3.00	46.75	0.39
0.60	7.2	10.0	1.8	72	3.00	63.65	0.53

3.3 Energy efficient roofs

3.3.1The physics behind the cool roof

Absorptance and reflectance of building materials are usually measured across the solar spectrum, since they will be exposed to that range of wavelengths and these are the major characteristics responsible for urban heat gain/ loss. The emissivity of building materials, on the other hand, is usually measured in the far-infrared part of the spectrum, since most building materials don't get hot enough to radiate at the shorter near-infrared, Visible and UV wavelengths. Installation of high-albedo roof coatings or paint is most cost-effective if done during new construction or when buildings are scheduled for re-roofing. Reflectance (albedo) is measured on a scale of 0 to 1, with 0 being a perfect absorber and 1 being a perfect reflector. The complement of reflectance is absorptance; whatever radiant energy incident on a surface that is not reflected is absorbed. Absorptance is also rated from 0 to 1, and can be calculated from the relation: reflectance + absorptance = 1. An ideal exterior surface coating for a cooling climate would have reflectance near 1.0, absorptance near zero, and infrared emissivity near 1.0 to radiate absorbed heat back to the sky. White plaster very nearly achieves this combination

3.4.2 Cool Roof Materials & Technology

Cool roofs can be selected from a wide variety of materials and colours, and can be advantageously applied to almost any building or roof type, and in most locations. Moreover, cool roofs are a viable option for both new and existing building applications. However, the extent of the benefits will correlate to the location of the building (i.e., climate), type and use, as well as to the specific thermal properties of the selected roofing product. For new buildings, the incremental cost of adding cool roofs is minimal, or, at times, none. For existing buildings too, the additional expenses may be insignificant if the retrofit is properly integrated with the reroofing schedule. Conventional materials for standard roofing are now available with their cool roof counterparts. The SRI for common roofing materials

Broken China Mosaic

Terracing Well-graded broken pieces of glossy glazed tiles provide an inexpensive and conducive cool roofing option. Broken pieces of

Glazed tiles (preferably white) are embedded in wet mortar to provide a smooth surface that does not undulate. The joints are then grouted using cement mortar with waterproofing material.

Modified Bitumen

Modified bitumen is bitumen (asphalt or tar) modified with plastic and layered with reinforcing materials then topped with a surfacing material. The radiative properties of modified bitumen are determined by the surfacing material, So a cool modified bitumen product will be finished off with a cap sheet or coating to achieve a high solar reflectance.

Slate or Tile

These roofing products are commonly used for residential buildings, or steeper-sloped buildings, and increasingly, for commercial buildings. Slate and tile products are available with solar-reflective surfaces that offer a wide range of cool colours. Additionally, the dense, earthen composition of slate and tile products provides increased thermal mass, yielding additional energy savings not realized through solar reflectance and thermal emittance measures alone. Concrete and clay tiles may be obtained in white, increasing the solar reflectance to about 70 percent (compared to the 20-30 percent range for red tile)

IV.COOL COLOURS

Technology has enabled the increase of the reflectance of a material by selectively increasing reflectance of non-visible radiation, without altering the reflectance of the visible part of the spectrum is now possible that two identical looking products may vary significantly in terms of thermal reflectance.

'Cool colour' roofing materials are created by integrating pigments that reflect infrared energy, even though their colour may still absorb some of the visible spectrum. In this way, roofing products can be both 'cool' and dark coloured. This type of infrared reflective pigment has been used in conjunction with a variety of product types, including metal, tile, and coatings, thus broadening the scope of cool roof applicability. While the energy savings of a dark coloured cool roof will not be equivalent to that of a white or lighter coloured roof, it will deliver more energy savings than its traditional non-cool counterpart.

V.CONCLUSION

- Shade east and west-facing glass by adding or relocating shade structures including verandas and deep covered balconies reduce the amount of south, east And especially west-facing glazing, or relocate some to north-facing walls. Select smaller windows on south, east and west- facing walls to aid cross-ventilation
- Technical potential is realized in moderate to hot climates with large area un shaded windows facing east, south, or west. Significant peak demand reductions are possible, again depending on window orientation, size, and climate
- Solar energy and energy efficiency must both be an integral part of any future energy system that addresses the issues of sustainable development.
- Solar energy and energy efficiency must both be an integral part of any future energy system that addresses the issues of sustainable development.
- A north-facing slope increases the potential for access to northern sun and is ideal for higher housing densities A south-facing slope increases the potential for overshadowing
- Smaller windows on south, east and west-facing walls to aid cross-ventilation.

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