



DESIGN OF ENERGY EFFICIENT & THERMALLY COMFORTABLE (EETC) RESIDENTIAL BUILDINGS

The design of a comfortable and energy efficient residential building largely depends on the design and properties of its building envelope (i.e. walls, windows and roof). This is complemented by efficient lighting and appliances. Clean energy generated from renewable sources in the building premises completes this picture of energy efficiency.

BUILDING ENVELOPE

The building design and envelope should boost thermal comfort to the extent possible in the given climate. For this to be possible, the building's design should:

- Reduce heat gains into the house (in hot climates), and reduce heat loss from the house (in cold climates)
- Allow for adequate natural ventilation, when needed.

These 2 requirements can be achieved through a few simple design guidelines:

- Orient the building to minimise solar exposure on vertical surfaces and for optimal utilisation of wind flow for ventilation.
- Select the building shape and massing to minimise or maximise solar exposure on vertical surfaces, depending on the climate zone, and to influence the building's wind access.
- Conduct a solar exposure analysis before deciding on building massing and spatial configuration. If there are other buildings in close proximity, this would also help understand mutual shading patterns.
- Reduce heat gain through the roof in hot climates by using insulation, shading the roof, or installing a high reflective finish.
- Windows on different orientations require different shading strategies.
- Optimise window sizes to allow enough daylight and ventilation. Window to Wall area ratio (WWR) should be between 10% – 30%, depending on the amount of mutual shading by surrounding objects, allowing good balance between adequate daylight and reduced heat gains.
- Shade windows to cut off solar radiation in hot climates.
- An insulative wall and installing doubled glazed units on windows will help reduce heat gains through walls and windows in hot-dry, composite, and cold climate zones. In warm-humid regions, it is more important to shade the windows than increase the wall insulation and use double glazed units.



- Design and position windows to improve natural ventilation, be it cross-ventilation or single-sided ventilation.
- Seal windows properly. In hot climates this reduces hot air infiltrating from outside when you're using the air-conditioner. In cold climates, properly sealed windows reduce cold drafts entering the home. Both strategies reduce electricity consumption.
- Use casement windows (or windows with hinges) instead of sliding windows. For the same window size, casement windows have more openable window area than sliding windows, allowing better ventilation potential. This is especially needed in warm humid climates.

Eco-Niwas Samhita 2018 (Part 1: Building Envelope) is the energy conservation code for residential buildings in India. The code sets minimum building envelope performance standards for residential buildings and the above guidelines comply with those standards.

EQUIPMENT

Certain equipment can make a residential building more thermally comfortable.

- In case of hot-dry and composite climates, use evaporative cooling when possible.
- Use highest star-rated equipment and household appliances, including LEDs lights, star-rated ceiling fans, air-conditioners and other appliances.
- When using an air-conditioner, raise the cooling set-point up to 28°C and use along with a ceiling fan. The saving potential in cooling energy demand when increasing cooling temperature set-point from 24 °C to 28 °C is at least 55%.
- Incorporate energy-efficiency features in the design of shared services like common area lighting, community water pumping system, and lifts.

RENEWABLE ENERGY

The building itself can be a source of energy generation. To do so utilise rooftops and other feasible open areas for renewable energy generation. For e.g. solar water heaters for hot water generation or solar PV for electricity generation.