

Orientation of Rooms in a Building to Achieve Energy Efficiency and Aesthetics at the Same Time

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Abstract: Orientation is basically based upon positioning of building as per seasonal variations in sun's path and changing wind patterns. For comfortable living and to experience pleasure of space, good orientation of building always helps by making it more energy efficient. As per increasing demands of energy proper planning of units and orienting them accurate to utmost possible extent helps building to achieve energy efficiency and provide comfortable environment to users.

Keywords: Orientation of rooms in a building, achieving energy efficiency, aesthetics, importance of energy efficiency.

1. Introduction

With modernization, a drastic development in buildings and infrastructure all over the world is observed. With increase in energy and aesthetical demands there is requirement of key analysis of project energy efficiency on initial stages of planning. Building and its element's orientations is decided by required views, housing layouts, site topography, sun path, prevailing winds, buildings around etc. Apart from orientation, every element of building be it openings, their size, materials used, techniques used all contribute in energy consumption and carbon emissions of a buildings.

Also, as aesthetics is important for physiological and psychological wellbeing of humans, as they happen to be most effective part of impression of building on mind. Thus, For a comfortable and pleasant accommodation, it is very important for planner to focus that to design a building energy efficiency and aesthetics should go hand in hand.

2. Related work

A. Literature review

1) *Site Planning and Orientation for Energy Efficiency (Nurul Akman Naamandadin); 2016*

A well designed building with proper orientation and aesthetics provide long term building optimization as well as minimal energy consumption. The orientation of site, building and rooms must be done with respect to sun path, wind pattern of area and utility of spaces. The results of this study comes with outcomes for best orientations of buildings and rooms.

Study of passive heating systems, heat gain and loss by a building that plays a key factor in providing thermal comfort to user.

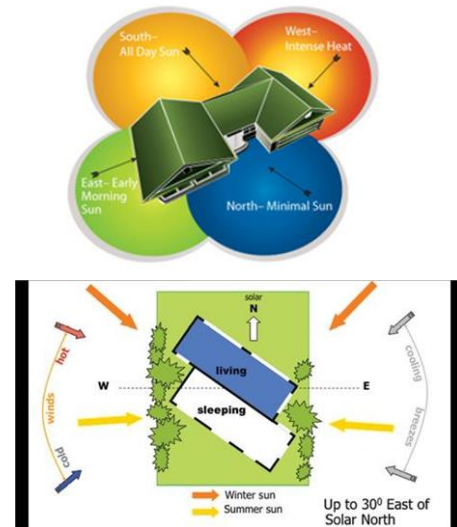


Fig. 1. For composite climate

2) *Aesthetics and Architectural Education and Learning Process (Mohammad Javad Mahdavinjad); 2013*

Aesthetics has a lot to do with architectural design practice as it is the outcome of all efforts that are put in into designing of a project. Training students towards sustainable yet appealing aesthetics from initial levels would help students to meet the energy and aesthetical needs of building and move towards better solutions for comfortable stay. Aesthetics deal with sensorial understanding. User has to see beauty and unity in work, admire it and feel comfortable by sight. Along with energy efficiency the elements of aesthetics such as form, symmetry, proportions, ornamental elements should be designed in a manner that it should appeal user and give a soothing feel to the space. Aesthetics can be considered as an interactive tool in an architectural space. Aesthetic goals can be achieved by putting in little efforts towards user comfort and requirement and also it can also contribute to energy efficiency

of a building through shading devices, colours, textures, blinds etc.

B. Case study

1) Tatva-residential building in Indore



IGBC Platinum rated and 5 star rated house by GRIHA situated in Indore. The design is been created with idea of creating identity by architectural expression of ethos of an architect. A Dwelling that states an example of modernization, effectivity, innovation in today’s world.

It proves that a green building can be on the same hand effective, attractive and can also result in longevity. It is designed to use less energy than standard energy requirement, being a day lit house, it ensures enhancement of natural ventilation and lighting so exceptionally that the cool breeze ventilates all other parts of house while passing through a strategically located swimming pool. Courtyard concept bringing the landscape inside creates mesmerizing effects.

Several other elements like proper orientation and size of windows welcome plenty of natural light into room reducing lighting and cooling energy requirements to a great noticeable extent. 100% use of LED lights with day light sensor help in achieving 0.5Watt per sq.ft consumption against the routine 6-8 Watt consumption. Other factors include use of locally sourced and low embodied energy material, minimizing use of RCC and use of light weight AAC blocks. Other elements like Landscape design, water heating systems, waste composting system, meeting irrigation demands for landscape area through sprinkler system make the design move towards achieving energy efficiency to a major extent.



2) Building energy codes

Building energy codes are used to establish minimum energy performance features in residential and commercial buildings

sector. The three methods used to calculate the method of limiting heat gain /loss through a building envelope are:

- *The elemental method:* According to this method, certain building elements such as roof, floors, windows, doors etc. should achieve minimum thermal resistance (U-Factor).
- *The target U-Value method:* According to this method the target U-Value and the average U-Value for subject building should be calculated. If the average U-value of the proposed dwelling does not exceed targeted U-Value then approval is shown.
- *The energy rating method:* This approach takes into account ventilation rates, service water heating, internal heat gain, and solar gains by building.

Factors affecting orientation of rooms in a building:

- *Climatic Factors:* Solar radiations, air temperature, air humidity, precipitation, wind pattern, Land and water, Altitude, Topography influence orientation of room of a building to a great extent and thus affecting energy consumption.
- *Climatic zones in India:* Based upon the above stated climatic factors India is divided into 6 climatic zones: Hot and Dry, Warm and Humid, Moderate, Cold and Cloudy, Cold and sunny, Composite. Each climatic zone requires various studies based on which certain generalized observations are derived like; courtyard type planning is considered good for warm and humid areas to maintain air flow throughout the area. Thus basic idea for design of houses in Kerala is that they should have courtyards in them (on general). Such kind of observations help designers to design a comfortable livable space.

Passive Building Design Concepts: For almost all climatic conditions, there are few passive design concepts that help designers to develop comfortable spaces without use of artificial devices and thus increasing energy efficiency of unit.

- *Passive heating system:* Increasing heat gain and reducing heat loss inside a building without conventional heating methods that utilize nonrenewable sources of energy.
- *Passive cooling concept:* Achieved by reduction of unnecessary thermal loads acting on a building. Proper orientation of rooms and proper design of ventilation systems can reduce impact of internally generated thermal loads.
- *Design of passive ventilation systems:* Proper design of ventilation systems such as windows, vents or other elements should be done by calculation of stack effect, wind pattern of that area, landscape around and user requirements.

3. Benefits of energy efficiency in a building:

1. Long term energy and cost savings: Energy efficient

Buildings have advantage of low energy, water and maintenance costs.

2. Lower emissions and great impact on environment: Energy efficient buildings have reduced amount of greenhouse gas (CO₂) emissions as they use less amount of fossil fuels.
3. Increased thermal comfort: Well oriented rooms and well-designed ventilation systems work together to maintain indoor thermal comfort.
4. Improved comfort and Health: Proper design of ventilation systems provide mental and physical comfort to users thus improving work productivity and health aspects.
5. Higher Resale Values: Now a days, consumers see potential value in energy efficient buildings as a result there is a premium tag associated with buying or leasing of well-built spaces.

4. Promotional schemes from government

Standards and Labelling: Ministry of power through bureau of energy efficiency initiated the standards and labelling programme for appliances in 2006 to make consumer informed about their choice its energy effectivity thereby reducing their

energy bills. Energy Conservation Building Codes (ECBC): Developed by Govt. Of India in year 2001. It defined norms and standards for energy performance of buildings and their components based on climatic zones in which they are present.

5. Conclusion

India being the 2nd most populated country, there is enormous requirement of energy sources and land. According to current developing scenario there is urgent need to generating awareness between citizens for energy saving and thus studying above data we can conclude that, a space can be energy efficient and on the same hand can be aesthetically appealing also. Awareness can be generated in public that can promote a better lifestyle and a healthy space to live in.

References

- [1] Indian Building Congress, Practical Handbook on Energy Conservation in buildings.
- [2] The Energy and Resources Institute, the Energy Efficient Buildings in India
- [3] <https://powermin.nic.in/en/content/energy-efficiency>
- [4] https://www.academia.edu/Documents/in/Energy_Efficiency_Buildings
- [5] <http://www.builtconstructions.in/OnlineMagazine/BuiltConstructions/Pages/Tatva---Residential-Building-with-Absolute-Serenity-0314.aspx>
- [6] https://en.wikipedia.org/wiki/Energy_Conservation_Building_Code