International Journal of Technical Research and Applications e-ISSN: 2320-8163,
www.ijtra.com Volume 4, Issue 3 (May-June, 2016), PP. 220-222

ENERGY PERFORMANCE OF A BUILDING IN NITTE CAMPUS

Hamsashree [1], Dr. Udayakumar G.[2]
P.G. Student, Professor,
Department of Civil Engineering, NMAMIT Nitte, Udupi,
Karnataka. Affiliated to VTU- Belgaum[1]
hamsajain@gmail.com[1]
kudayg6@gmail.com[2]

Abstract: **The problem regarding Energy performance of a building arises due to lack of imprecision of building design and energy analysis methods. This study provides with the requirements needed to analyse the energy performance and opportunities to improve the energy performance. This study follows Energy Conservation Building Code (ECBC) to achieve energy efficiency of buildings.**

Keywords: **Insulation material, U-factor, Solar heat gain coefficient, Installed lighting power.**

I. INTRODUCTION

Energy Performance of building is a concept which is not well-defined. Many studies have been carried out previously on the energy performance but it is said that the concept is not fully understood. There is no particular definition to what energy performance is, but it can be defined as the energy consumption or use for an existing or proposed building. Energy performance study is carried out on one of the buildings in Nitte Campus, New Lecture Complex. The major components of energy consumption are Heating Ventilating Air-Condition (HVAC) component, Lighting System and building related equipment such as electric motor, transformers. While assessing the energy performance not only the above mentioned components but Building Envelope such as opaque constructions and fenestration should be considered. The material used for these plays a prominent role in contributing to the energy performance of building. There is a need to decrease the electricity used in the developing countries, by adopting improved techniques in order to increase the performance which will lead to the conservation of energy. For this purpose different countries has adopted or introduced its own standards and codes which provides the standard methods and values that should be met to increase the performance. The Indian government in 2001 enacted the Energy Conservation Act (EC Act) which provides for the legal framework, institutional arrangement and a regulatory mechanism at the Central and State level to embark upon energy efficiency drive in the country. The Bureau of Energy Efficiency (BEE) was established in March 2002 under the Ministry of Power (Mop) to implement the EC Act 2001. Among other programmers, implementation of the Energy Conservation Building Codes (ECBC) developed in 2007 which is a key thrust area of BEE for promoting energy efficient building design. The objectives of present study are (i) to introduce the concept of energy efficiency and its benefit (ii) to provide the methodologies to be used to determine the efficiency of buildings (iii) to present the different opportunities and measures for reducing energy use in buildings without sacrificing comfort levels.

II. DETERMINATION OF BUILDING ENERGY PERFORMANCE PARAMETERS

1. Building Envelope

The building envelope indicates the external facade which consists of opaque components and fenestration. Components such as wall, roof are compromised of different layers of materials which has different thermal conductivity (k). Hence it is important to achieve thermal resistance (R) and thermal transmittance (U-factor).

Calculation of R-value and U-factor for wall

New Lecture Complex building is constructed using Laterite stone of thickness 9" with plastering on either side of thickness 150mm.

$$R_T: R_{si} + R_t + R_{se}$$

Where R_t: Total thermal resistance

R_{se}: Exterior surface thermal resistance

$R_{si:}$ Interior surface thermal resistance

$$R_t: R_1 + R_2 + \ldots + R_n$$

Where R_1, R_2.., R_n are the thermal resistance of each layer

$$\text{U-factor} = 1/R_T$$

Calculations determine that the U-factor of the wall is 1.960 W/m^2K. The lower the U-value is, the better the material is as a heat insulator. The current building regulations call for a maximum U-value of 0.35 W/m^2K with insulation.

Calculation of R-value and U-factor for roof

The RCC slab is of thickness 5" with 8mm reinforcement bar. By similar calculations to that of wall the U-factor is determined to be 0.957 W/m^2K. The current building regulations call for a maximum U-value of 0.13 W/m^2K with insulation.
The graph shown below in Fig 1 shows the difference in U-factors of wall and roof according to ECBC and calculated value.

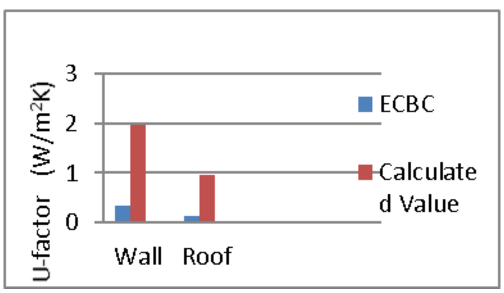

Fig 1: Comparison of U-factor

2. Fenestration

Heat transfer across the glazing is similar to that of wall and roof. Performance of glazing depends upon certain factors about glazing which are Thermal transmittance (U-factor), Solar heat gain coefficient (SHGC), Visible light transmittance (VLT).

Fenestration Description in Engineering Building

Saint Gobain PARSOL Glass is been used in the building for windows. Technical information on the glazing is provided in the below Table 1 which is obtained from the Saint Gobain Glass Performance Sheet.

Table 1

Property	**Range**	**High performance glazing range**	**Saint Gobain glass**
Shading coefficient	0-1W/m^2K	0.1-0.4 W/m^2K	0.69 W/m^2K
U-value	0-5 W/m^2K	1.7-3.0 W/m^2K	5.8 W/m^2K
VLT	0-100%	40-60%	60%

The glazing provided does not meet to the standards provided. Shading coefficient and U-value should be less to provide good performance. VLT should be high to perform well and it meets up to the standard. A graph shown below in Fig 2 shows the different ranges of SHGC, U-value and VLT of glazing.

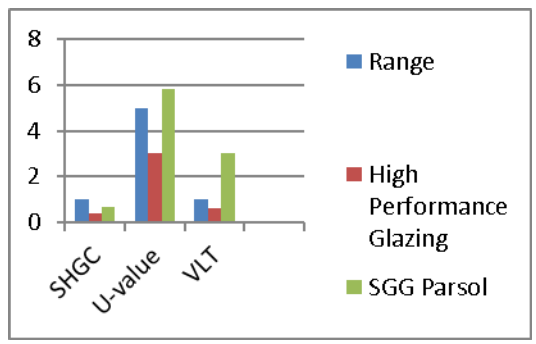

Fig 2: Comparison of Glazing Values

3. Lighting

Lighting accounts for the main energy consumption in India. Therefore this is the domain where the advanced techniques can be adopted to decrease energy to how much extent we want. The installed interior lighting power is first calculated that is installed in the building by the one of the methods suggested by ECBC. The current calculation is based on

Building Area Method which suggests that Installed Lighting Power (ILP) value should be less than Lighting Power Allowance (LPA) value. The calculations determined that ILP value is less than LPA value. Since ILP value is less than LPA value. Lighting system of the building complies with ECBC.

III. RESULTS

As recommended in ECBC the thermal transmittance for wall and roof should be minimum as possible; if not insulation materials should be provided which will decrease the thermal transmittance through wall and roof. The glazing used should be such that it has low thermal transmittance, low solar heat gain coefficient and high visible light transmittance. Along with these the effective aperture of the glazing should be such that the daylight received in to the building should be enough not to use light. The main domain where energy can be reduced to larger extent is the lighting system by adopting effective lighting system and control lights considering the building envelope and fenestration system.

IV. CONCLUSION

To increase the energy performance there are certain factors that has to be considered according to ECBC such as thermal transmittance and insulation materials for wall and roof, glazing properties, lighting system. Studies have showed that by following ECBC energy used in a building can be reduced to 30%-50%.

ACKNOWLEDGMENT

I express sincere gratitude to **Dr. Srinath Shetty K, HOD**, Department of Civil Engineering, NMAMIT, NITTE for his kind support. I would extend my gratitude to the respected Guide, **Dr. Udayakumar G**, Assistant Professor, Department of Civil Engineering, NMAMIT, NITTE for their valuable support and guidance. I would also thank all the teaching staff of our department for their valuable suggestions and support.

REFERENCES

[1] Ashok Kumar, B.M. Suman, "Experimental evaluation of insulation materials for walls and roofs and their impact on indoor thermal comfort under composite climate", Building and Environment, Volume 59, January 2013, Pages 635-643.

[2] Axel Berge, Pär Johansson, "Literature Review of High Performance Thermal Insulation", Report in Building Physics, Chalmers University of Technology, Report 2012:2, ISSN 1652-9162.

[3]Baird., "Literature Review on Energy Performance of Buildings", Preface, University of Hong Kong, 1984

[4] Joseph Iwaro, Abraham Mwasha, "A review of building energy regulation and policy for energy conservation in developing countries", Energy Policy, Volume 38, Issue 12, December 2010, Pages 7744–7755

[5] Zhenjun Ma, Paul Cooper, Daniel Daly, Laia Ledo, " Existing building retrofits", Energy and Buildings, Volume 55, December 2012, Pages 889-902.

[6] A Synnefa, M. Saliari, M. Santamouris, "Experimental and numerical assessment of the impact of increased roof reflectance on a school building in Athens", Energy and Buildings, Volume 55, December 2012, Pages 7-15.

[7] Suresh B. Sadineni, Srikanth Madala, Robert F. Boehm, "Passive building energy savings: A review of building envelope components", Renewable and Sustainable Energy Reviews, Volume 15, Issue 8, October 2011, Pages 3617-3631.

[8]Energy Efficiency Improvements in Commercial buildings, United Nation Development Programme, India, April 2011

[9]http://www.eere.energy.gov/buildings/documents/pdfs/26467.pdf