Journal of Engineering and Applied Sciences 12 (Special Issue 2): 6160-6162, 2017
ISSN: 1816-949X

Energy Assessment over a Solar Cladding by Using Geographic Information System

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Abstract: The principle concern of this study is to assess solar absorption coefficient over solar cladding on building and to reduce the high room temperature due to the excess solar radiation over the wall. Simulations were carried out on a college building (kings college of engineering) by using the solar analysis in autodesk Formlt 360, finding a energy efficient wall of an building and solar cladding installation carried out over that area and audit the solar absorption coefficient in the solar cladding. As an results to reduce the room temperature which also decreasing the energy usage by minimizing the usage of fans and leads to a get an sustainable solar energy from solar cladding, by production of renewable energy form solar cladding it reduce the CO_2 emission which are generated during the production of energy from fossil fuels.

Key words: Solar cladding, Formlt 360, energy efficient building, Kings College of Engineering, solar energy, GIS

INTRODUCTION

The solar radiation to a building material is exposed has a very direct effect on its indoor temperature and humidity and increase the room temperature which affect the body temperature and it may reduce the efficiency of human brain which can be controlled by the solar cladding. Temperature and humidity distributions vary with building and wall orientation while solar radiation, wind and rain affect not only wall surfaces but their inner cores as well as Wu (2003).

The world has fortunately become increasingly cognizant of the significant potential of solar energy as a replacement for non-renewable fossil fuel energy. The sun is a clean, unlimited and almost infinite energy source, providing each hour on earth as much energy as the whole world needs in a year. Proven technologies are able to transform its radiation into heat, electricity and even cold and are now largely available at affordable prices. When others make use of energy to cool there building and warming up the whole world but in this study we are utilizing the solar energy to reduce the temperature of the building and also make use of renewable energy source by using solar cladding and which converting the solar energy to electrical energy and also reduce the emission of carbon dioxide which are produce during the production of fossil fuels (Fridley and Zheng, 2008).

Analysis: The impact of solar radiation can be determine by using computer application and finding the high radioactive college building block over the college camps where major analysis carried out for those building and audit the solar absorption coefficient (Sweatman, 2012). Expect Block 1 and 2 all other block where covered with trees hence the solar radiation maximum is stopped and it all have good geometrical structures like sun shade. But Block 1 directly facing the west direction hence it affected by radiation in afternoon time but it majorly rectified by arches design in front side, so it maximum minimized (Fig. 1).

As like Block 2 major area is directly expose to solar radiation and also absence of sun shade hence it also make the way or more sun radiation and the Block 2 it's not perfectly 90°, it turns with an angle of nearly 20° this factors plays a major role in analysis of solar radiation (Fridley and Zheng, 2008) (Fig. 2).

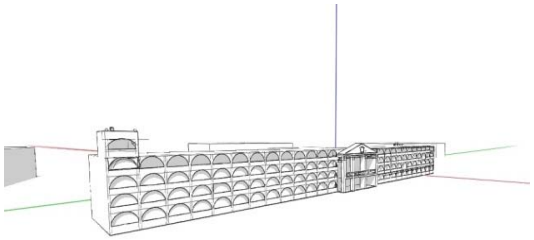

Fig. 1: Fornt view of Block 1

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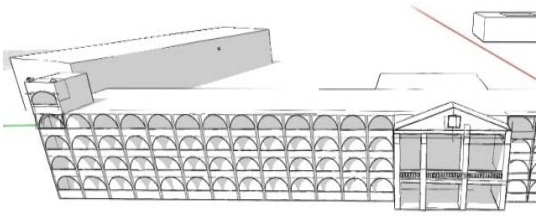

Fig. 2: Block 2 inclined with the angle of 20°

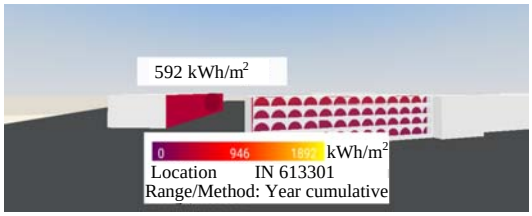

Fig. 3: Year cumulative analysis

MATERIALS AND METHODS

Method of analysis: The solar radiation of exterior wall of the block which majorly affected by the radiation. The solar radiation differed place to place to and also differs with time. Hence, analysis done at the afternoon becase it has effective solar radiation and analysis carried out for whole form month of January-December. The solar radiation measure in the unit kWh/m^2 (Fig. 3).

Procedure: 3D model of the anglicised building is important for thermal analysis of building with more accuracy and angle of the building and location is highly important. The location and perfect angle of the building is adopted for highly accurate source as like Google Earth, Flux, the 3D model is created by using Autodesk Formlt 360. The thermal analysis done by Autodesk Formlt 360. The thermal analysis done for all months for two block and the result where explain by graph the monthly comparative analysis. The solar cladding installation done over a Block 2 about an area of 1125 m^2 by 720 modules (Fig. 4).

Heat problem due high temperature: The healthy human body should be maintaining its body temperature around 37°C. Variations, should not <1°C, the change will occurs time of the day and level of emotional or physical activity. Change in body changes occurs only during the time of illness or when the surrounding temperature change in high level (Fridley and Zheng, 2008).

When the surrounding temperature increase the human body also tends to increase the internal temperature. The internal temperature of a body is maintained by process of thermostat which pumping the more blood to the skin by increasing production of sweat. By this way, the heat loss is increased by the human body due to heat burden. The heat grain is more than the heat loss due to high temperature in surrounding. The internal

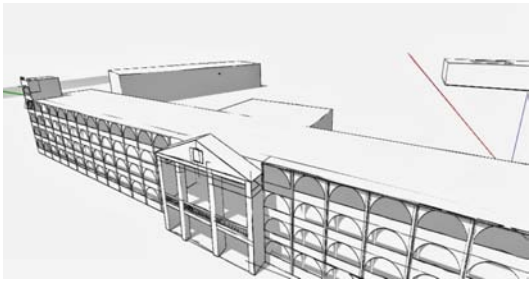

Fig. 4: Building created by autodesk Formlt 360

body temperature will arise when the surrounding temperature is high (Fridley and Zheng, 2008). As the temperature or heat burden increases, people may feel:

- Increased irritability
- Concentration reduced to do mental task
- Amount of mental stress will increase which affect the efficiency of work

RESULTS AND DISCUSSION

The analysis gives the result that Block 2 have the chance to affect by solar radiation, hence the solar cladding installed over the elevation the Block 2 about an area of 1125 m^2, the graph given below shows the comparative thermal analysis report (Probst and Roecker, 2012). The result determined by both year cumulative and monthly peak analysis (Table 1 and Fig. 5):

- In the month of June great fall in radiation about 67.34 kWh/m^2 due angle of the Block 2 plays the huge role in it
- The Block 2 have the inclination of 20°, hence the fall in radiation occurs
- Due the angle of the Block 2 at the month June the radiation is reduced 603.3-67.34 kWh/m^2
- Table 1 shows the amount of radiation in several months and its value obtain by thermal analysis
- The thermal analysis done by yearly cumulative analysis method

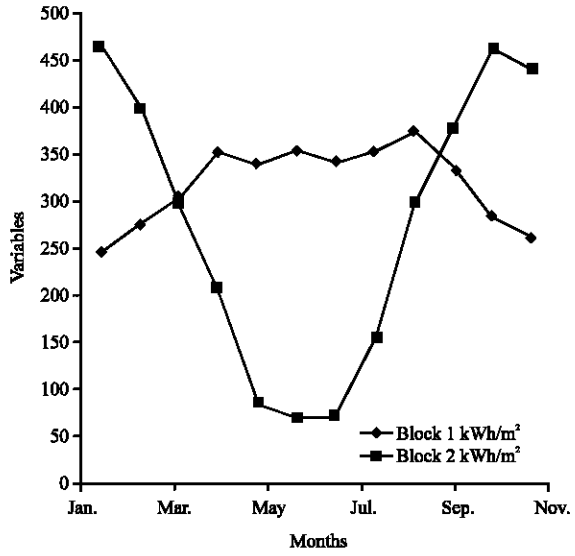

Fig. 5: Compartive analysis of Block 1 and 2

Tale 1: Amount of rediation in Block 1 and 2

Months	Block 1 kWh/m^2	Block 2 kWh/m^2
Jan	244.7	465.0
Feb	274.0	399.4
Mar	301.2	286.1
Apr	349.9	205.3
May	339.0	86.26
Jun	352.0	67.34
Jul	339.6	68.76
Aug	352.7	151.0
Sep	372.1	294.9
Oct	334.2	371.8
Nov	281.6	460.6
Dec	262.3	441.4

Table 2: Year cumulative analysis of Block 1 and 2

Year cumulative	
Block 1 kWh/m^2	Block 2 kWh/m^2
390.9	523.6

- The angle of the Block 2 helps lot to reduce the solar radiation due 20° inclination

The solar cladding provided in elevation of the Block 2 building which reduces the indoor room temperature and audits the solar absorption coefficient as a result by reducing room temperature we can save electric energy by reducing usage of fan and air-condition (Alan and Maarten, 2007). Totally 140,000 kWh per year power generated by the solar cladding installed in the wall (Table 2).

Power and payback: Estimations only, correct at time of installation:

- System size: 182 kWp
- Annual generation: 140,000 kWh
- Annual CO_2 savings: 70 tones

CONCLUSION

The thermal analysis of building of the kings college of engineering gives the result the Block 2 have more solar radiation in the college campus and by provide solar cladding in that block the indoor temperature is reduced and the sustainable energy source obtained and generating 140,000 kWh per year which enough electricity for 25 average three-bed houses each year. Enough electricity each year to light an average three-bed house for over 128 years. And also reduce the 70 tone of CO_2 emission and the building reducing the green house gas, equivalent over 3 million party balloons or 26 olympic swimming pools. Annual CO_2 savings: account for 59 trees required to absorb CO_2 over 100 years.

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