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Is green low cost house possible? Towards low energy – low cost house

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Abstract

The low income house is not only excluded economically, but this exclusion has social and environmental dimension. Therefore, giving special attention to the low cost house is very essential to be low energy house, to maintaining the cohesion of the three dimensions of green architecture. Energy saving in building is one of the most important principals in economic benefits of green architecture. The study point out the importance that design housing external envelope is more sensitive to the thermal comfort indoor living in low house costing. Therefore the study will include main geometric shapes which can use to design the external envelope of building in North Sinai to achieved the most suitable house shape appropriate with environment of north Sinai, that decrease the total solar radiation on the external envelope of building. Finding will improve the indoor thermal comfort which can effect directly in reduce use equipment (which used for: heating at winter – cooling in summer) inside the building to achieve thermal comfort and that impact on energy consumption in low cost house in Bedouin villages at El-Hasana North Sinai.

Keywords: *low cost house, building envelope, thermal comfort, geometric building shape, energy consumption, solar radiation, Sinai.*

1. Introduction

Sinai has been inhabited for thousands of year by nomadic tribes, it's a land of Bedouin, who have dowelled here for time longer than history had recorded. Their mobile dwelling (Tent) has evolved purely and honestly from the raw materials available to them. The design and shape of tent process to be a model example of an architecture solution for such a dry hot climate.

The state work toward development cities in Sinai by construction new village in deferent sites called Bedouin villages. It interests with social needs to the original people which provide the house with side courtyard. In another side did not give attention to climatic condition and thermal comfort indoor building.

The study will focuses on Bedouin villages in north Sinai at El-Hasana city. Wherever the house area 62.8m^2 (8.45 m*7.44), house units consists of (two bed room – bath room – kitchen – reception).

Fig (1) shows the physical assembly of the residential units which built by the state and the subject of this study.

2. Goals and Objective

Primary objective of this study is achieving to the suitable shape of external envelope building, that improve the inside thermal comfort, which is the major element has effect on energy consumption. Because the way in which we construct and design buildings has a critical impact upon the environment.

3. Methods

These study methods have been follows:
1. The experimental methods using Autodesk Ecotect Analysis 2011 program.
2. Analysis the result using diagram.

3. Theoretical frame work

3.1 Economic green building:

The main idea about green building, it has been costing more expensive than traditional building, therefore, is not suitable for affordable housing. Many studies have notarized the costs and benefits of green building in the commercial and institutional sector that green building has a modest initial cost premium, have a modest initial cost premium, but the benefits over the life cycle of the building override the incremental capital costs. [3] Also, operations and maintenance costs while refinement the productivity, health, and well-being of occupants and the environment. In this way, green building has a positive impact on the occupants the building and the environment. [2]

3.2The effect of green building benefits in cost:

Green building design, construction and operation's techniques provide an integrated approach to energy efficiency. Green building is difficult development trend; it is an approach to building appropriate for the requirement of its time, whose relevance and significance will only continue to increase. The benefits of green building are various, and may be classified to major element: environmental, economic, and social. [6]

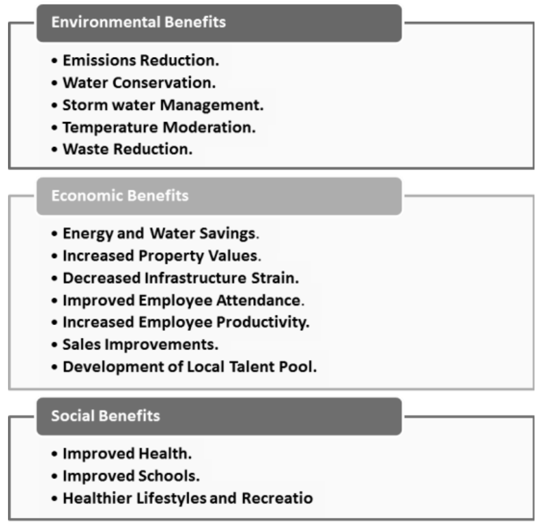


Fig (2) shows The benefits of green building.

3.3 green building design:

Generally, the green building is considered to be an environmental component, as the green building materials are crafted from local eco-sources, i.e. environmentally friendly materials, which are then used to make an eco-construction subject to an eco-design that provides a healthy habitat built on the cultural and architectural heritage in construction while ensuring conservation of natural resources. [1]

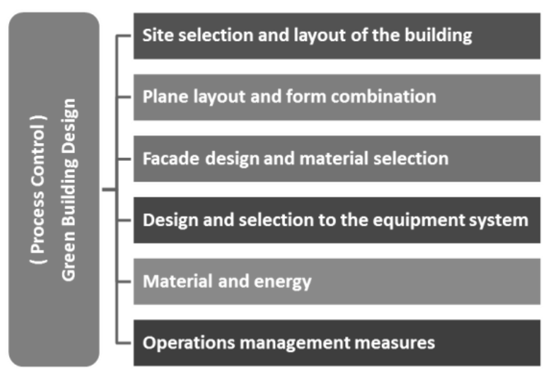


Fig (3) explain (Process Control) green building design

3.4 Envelope of building;

Envelope design is a main factor in determining the amount of energy a building will use in its process. The building shape and spaces greatly impact ambient temperatures in those spaces. This contains walls, windows, doors, roofs, and floor surfaces. The amount of radiation that enters and exits envelop can be controlled to improve the indoor thermal comfort which impact on energy consumption.

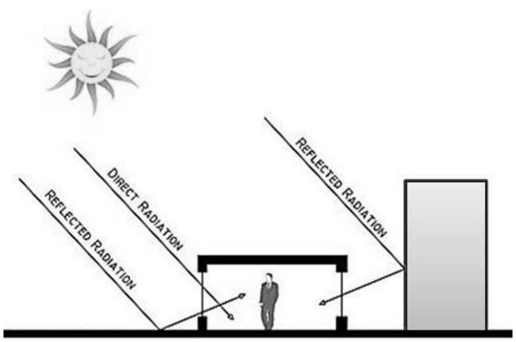


Fig (**4**) show total solar radiation on building. [7]

3.4 Thermal Efficiency:

The basic tenet of building energy efficiency is to use reduce energy for heating, lighting, and cooling, without impacting the comfort of those who use the building. High performance buildings not only save energy costs and natural resources, but also mean a higher-quality interior environment. The decrease of heat during the outdoor building envelope (the called transmission heat losses) is the major element in the cost structure of thermal energy.

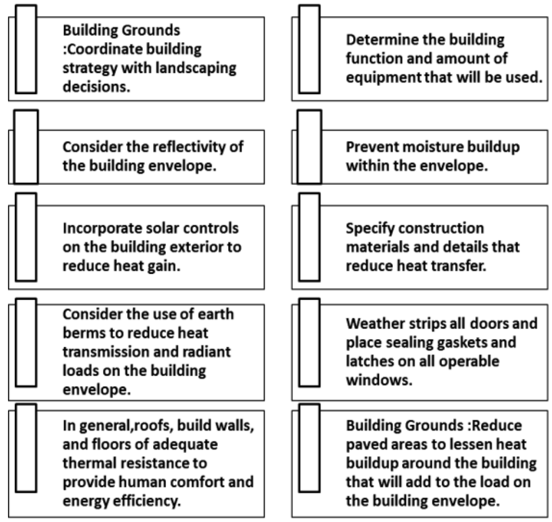


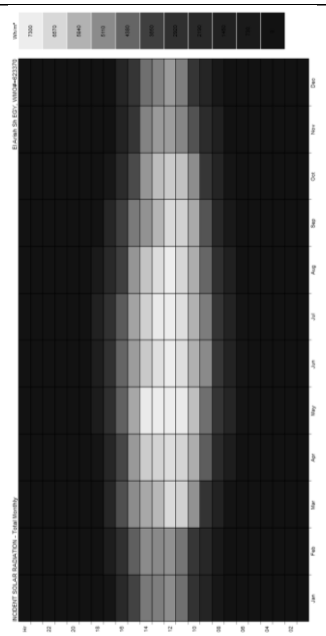
Fig (3) explain element effect in thermal efficiency

4. Case Study and Analysis:

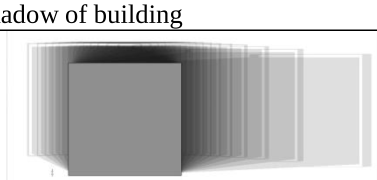
To achieve the suitable shape to the building which saving energy consumption by control total radiation on the building all over the year. So the study will include some geometric shapes in plan (square – rectangular – triangular – hexagonal – octagonal – pentagon – circle) area 62.8 m2 without opening and high 3m. Also analysis by use program Autodesk Ecotect Analysis 2011 and comparative the result program using digrame.

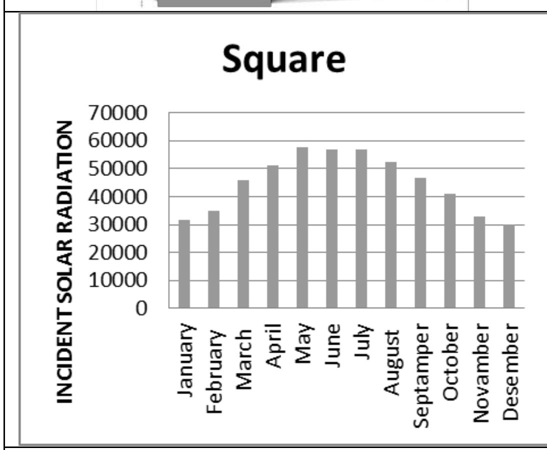
Shape **1:** **Square** (area 62.8 m2)

Total radiation on the building during the months of the year at 12Hr (program Autodesk Ecotect Analysis 2011)



The shadow of building





The highest solar radiation on May = 57482 Wh/m2

-The lowest solar radiation on December = 29828 Wh/m2

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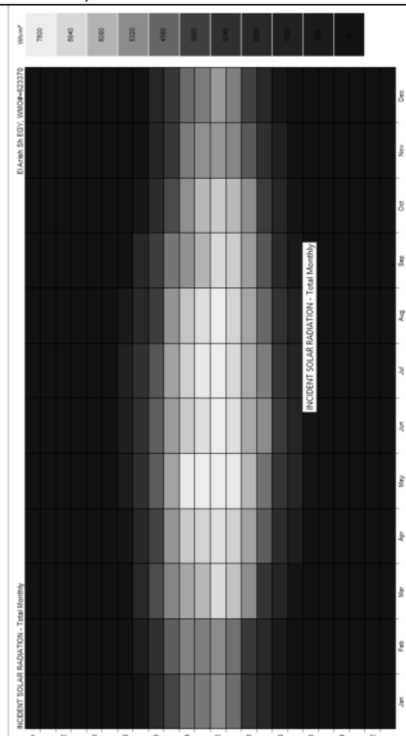
Shape **2**: **rectangular** (area 62.8 m2) **(8.45 m*7.44)**
Total radiation on the building during the months of the year at 12Hr (program Autodesk Ecotect Analysis 2011)

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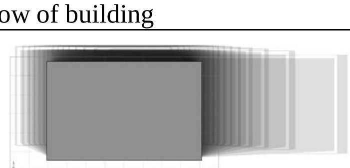
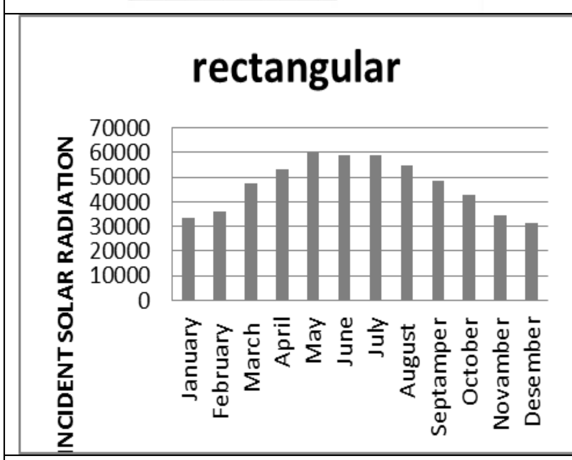
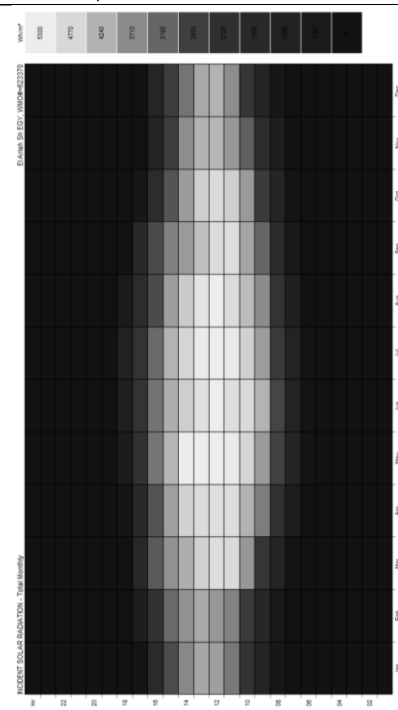


The highest solar radiation on May = 59757 Wh/m2 -The lowest solar radiation on December = 31572 Wh/m2

Shape **3**: **Hexagonal** (area 62.8 m2)
Total radiation on the building during the months of the year at 12Hr (program Autodesk Ecotect Analysis 2011)

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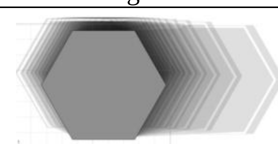
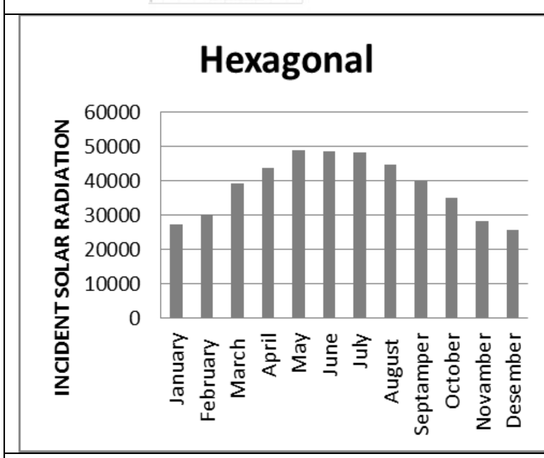
The highest solar radiation on May = 48781 Wh/m2

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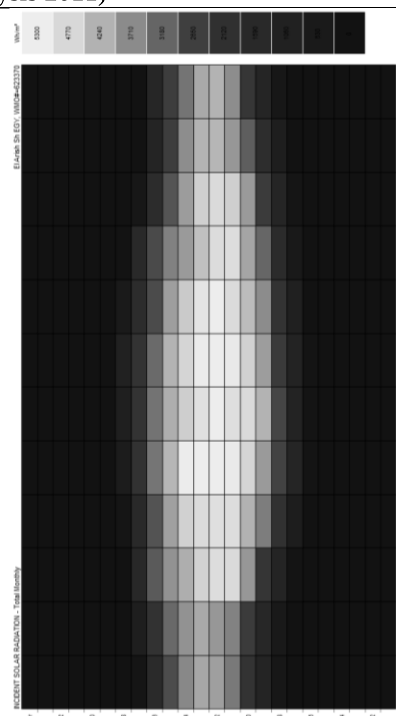
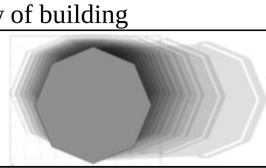
-The lowest solar radiation on December = 25701 Wh/m2

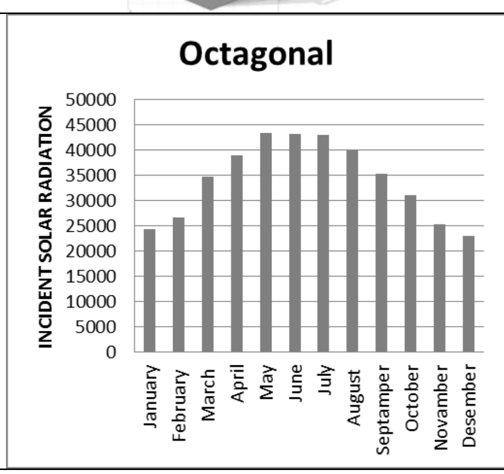
Shape **4: Octagonal** (area 62.8 m2)

Total radiation on the building during the months of the year at 12Hr (program Autodesk Ecotect Analysis 2011)



The shadow of building

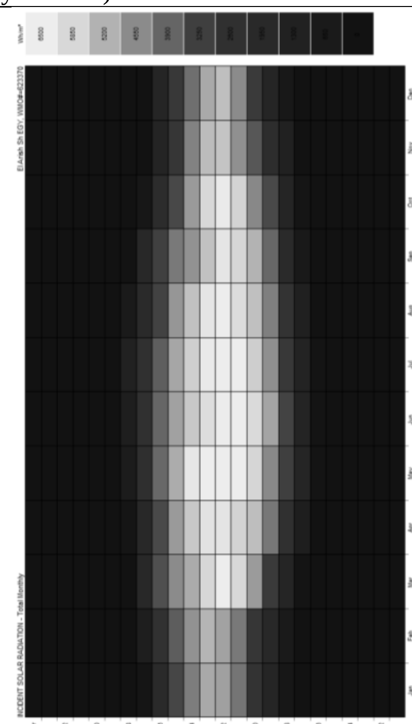




The highest solar radiation on May = 43478 Wh/m2
-The lowest solar radiation on December = 23036 Wh/m2

Shape **5: Pentagon** (area 62.8 m2)

Total radiation on the building during the months of the year at 12Hr (program Autodesk Ecotect Analysis 2011)



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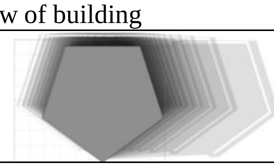
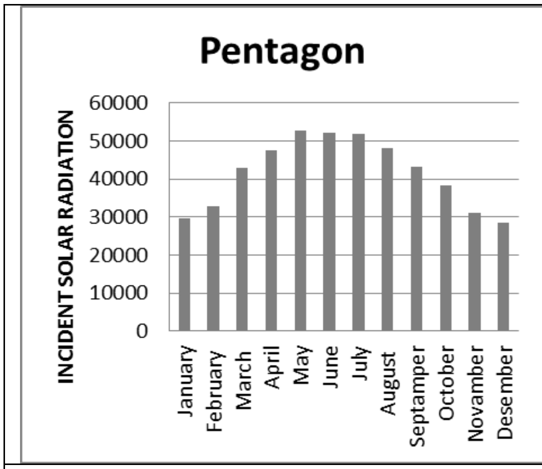
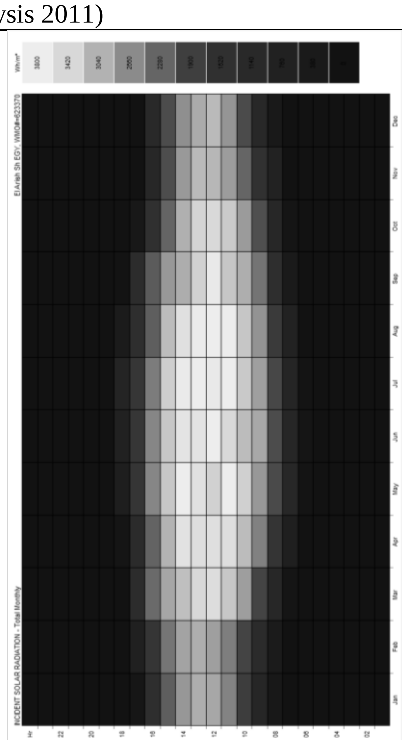




The highest solar radiation on May = 52733 Wh/m2
-The lowest solar radiation on December = 28338 Wh/m2

Shape **6: Circle** (area 62.8 m2)

Total radiation on the building during the months of the year at 12Hr (program Autodesk Ecotect Analysis 2011)



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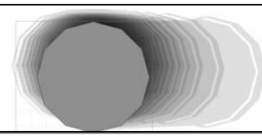
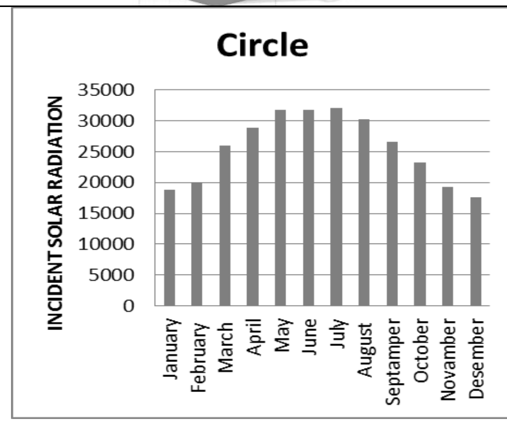
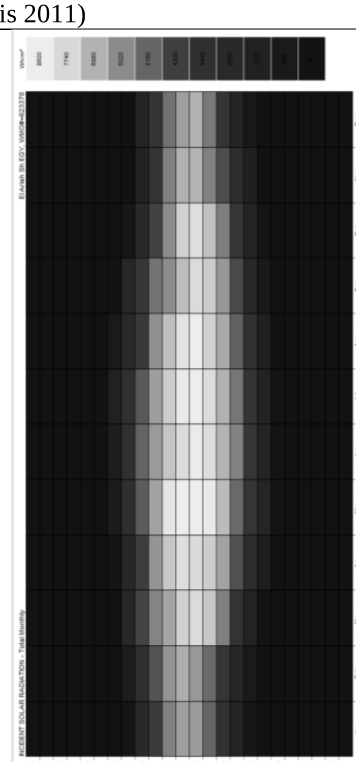




The highest solar radiation on May = 31699 Wh/m2
-The lowest solar radiation on December = 17657 Wh/m2

Shape **7: Triangular** (area 62.8 m2)

Total radiation on the building during the months of the year at 12Hr (program Autodesk Ecotect Analysis 2011)



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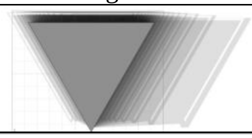
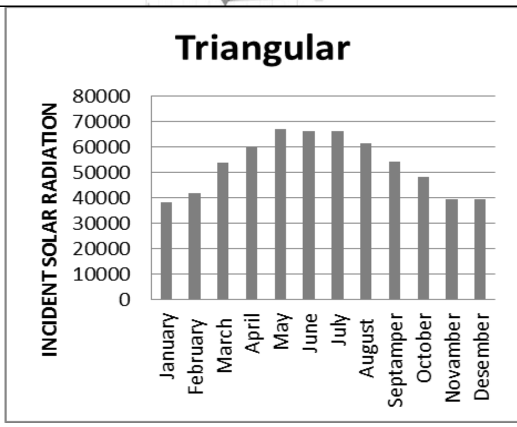
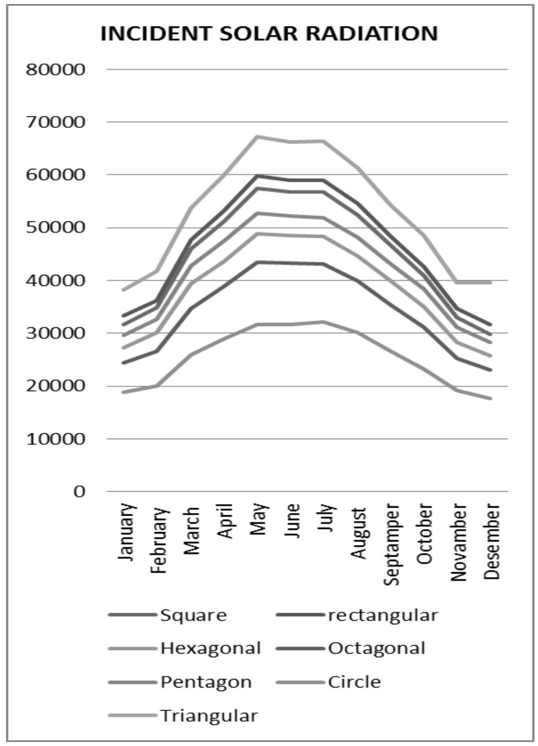




The highest solar radiation on May = 67247 Wh/m2
-The lowest solar radiation on Decembers = 36144 Wh/m2

4. Result

Comparative analysis the total radiation on the building during all the months of the year at 12Hr for all shapes (square – rectangular – triangular – hexagonal – octagonal – pentagon – circle).



	January	February	March	April	May
Square	31706	34943	45928	51238	57482
rectangular	33353	36157	47644	53203	59757
Hexagonal	27228	30179	39346	43691	48781
Octagonal	24421	26657	34740	38989	43478
Pentagon	29709	32723	42780	47438	52733
Circle	18847	20041	25956	28883	31699
Triangular	38206	41792	53772	59960	67247

	June	July	August	Septamper	October	Novamber	Desember
Square	56744	56752	52434	46696	40917	33010	29828
rectangular	58994	59015	54655	48434	42586	34611	31572
Hexagonal	48499	48405	44696	39845	35048	28331	25701
Octagonal	43221	43098	39845	35298	31079	25299	23036
Pentagon	52235	51901	48173	43120	38356	31101	28338
Circle	31725	32111	30179	26594	23217	19229	17657
Triangular	66318	66405	61295	54330	48467	39618	39618

The Circle is the suitable shape in the site of case study because it has the lowest total radiation on the building during all the months of the year at 12Hr. Rearranging another shapes exponentially after Circle is Octagonal, Hexagonal, Pentagon, Square, Rectangular, and triangular, wherever the total radiation increase on the building.

5. Conclusions

Conclusions and recommendations:

The design plan has main importance in decrease energy consumption in building, because it reduces the amount of solar radiation interlining building. Additional, it helps to decrease energy consumption in building.

The design plan has main importance in decrease energy consumption in building, because it reduces the amount of solar radiation interlining building. Additional, it helps to decrease energy consumption in building:

The Circle is the suitable shape in the site of case study because it has the lowest total radiation on the building during all the months of the year at 12Hr. In additional, the total radiation increases the heat gain in the building, that effect on to decrease the energy consumption indoor building. The total radiation decreased in all other months and that effect on heat lost, which help on decrease the energy consumption indoor building.

Acknowledgments

Insert acknowledgment, if any. Sponsor and financial support acknowledgments are also placed here.

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