IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁑ Impact Factor 8.066 ⁑ Peer-reviewed / Refereed journal ⁑ Vol. 10, Issue 9, September 2023

DOI: 10.17148/IARJSET.2023.10939

"Feasibility Study on Energy Consumption by Zero Energy Building"

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Abstract: The study is focused on a multi-family building block of flats type and includes an energy analysis on its construction and installations elements. Results conclude with energy performance indicators and recommendations for additional energy efficiency measures. Different packages of measures were analysed for economical efficiency and appropriate conclusions are drawn. It is thus shown how a building can approach conditions compatible with "nearly zero" energy consumption from classical sources, with reasonable costs for owners

Keyword: Nearly Zero Energy, Energy Performance, Solar Energy, Bio-Gas, Rain Water Harvesting, DEWATS

I. INTRODUCTION

The energy requirement of each buildingdepends on its utility. Another important factorrelated to the required of energy is thegeographical position of each building. There are three categories of building according totheir use:

- Commercial.
- Public.
- Residential.

Zero energy building which are connected to grid are Nearly zero energy building, Net zero energy building And Net plus or positive energy building. The goals of zero energy building takes us out of designing low energy building with the energy saving goal into sustainable energy. The goal that are set & howthose goals are defined are critical to the design process. Because design goals are so importantto achieving high performance building, theway a zero-energy building goal is defined to understanding the combination of applicableefficiency measures and renewable energy.

II. ZERO ENERGY BUILDING

As we know that zero energy building is also known as net zero energy building which meansthat a building with net zero energyconsumption that the total amount of energy is used by a building on an annual basis is equal to the amount of renewable energy. It based on the concept of building within its boundaries, produces as much energy consumed on an annual basis. In order to be appropriate for use,building should be providing comfort conditionfor people who are inside.

III. ADVANTAGES

- Isolation for building owners from futureenergy price increases.
- Increased comfort due to more-uniforminterior temperatures.
- Reduced requirement for energy.
- Reduced Total cost of ownership due toimproved energy efficiency.
- Reduced total net monthly cost of living
- Minimized extra cost.

IV. DISADVANTAGES

- Initial costs can be higher.
- Lack of skills or experience to build ZEBs.
- ZEB may not reduce the required power plant capacity.
- Solar energy capture using the houseenvelope only works in locationsunobstructed from the sun.
- Without an optimized thermal envelope,the embodied energy, heating and cooling energy and resource usage is higher than needed.

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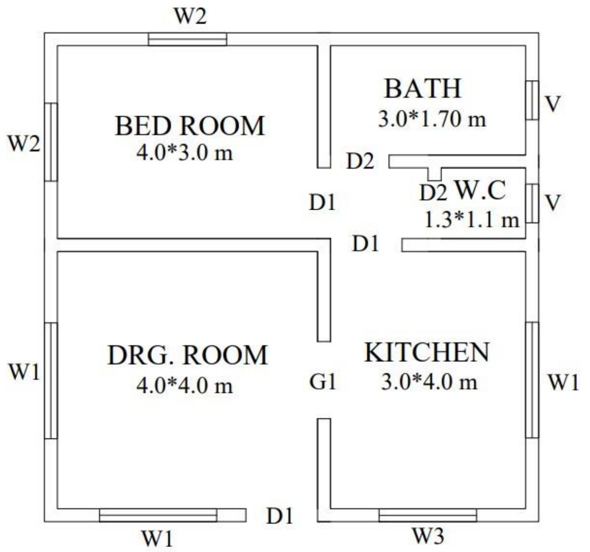
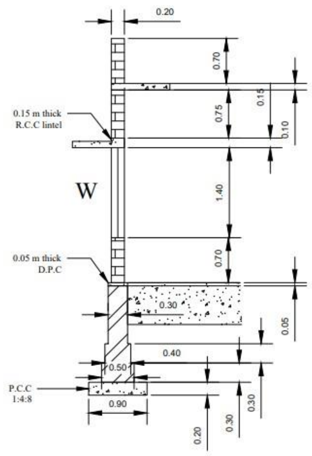
V. PLAN



PLAN



DOOR - WINDOW DIMENSIONS

NOTE: ALL DIMENSIONS ARE IN METERS

D1 = 1.1*2.1 m
D2 = 0.9*2.1 m
G = 1.2*2.1 m
W1 = 1.8*1.4 m
W2 = 1.2*1.4 m
W3 = 1.5*1.4 m
V= 0.6*0.6 m

Table 1: E E and Cost of materials used in construction of zero energy building

#	Type	Item	Units	Quantities	EMBODIED ENERGY (MJ)
1	Sub Structure	PCC	m^3	12.63	11133.05
2		SSM footing	m^3	12.312	4249.25
3		Plinth Beam	m^3	8.208	5345.94
4	Super Structure	Brick work with masonry	m^3	33.47	31587
5		Parapet wall	m^3	4.256	3903.021
6		Roof two-way slab	m^3	8.89	27015.44
7		Lintel	m^3	0.552	881.33
8	Finishes	Putty	m^2	0.3987	3662.89
9		gypsum plastering	m^2	2.658	1722.38
10		Flooring vertical tiles	m^3	0.5584	8394.1
11		Painting	m^2	312.33	10416
	TOTAL				108330

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Table 5.2: E E and Cost of materials used in construction of conventional building

#	Type	Item	Units	Quantities	EMBODIED ENERGY (MJ)
1	Sub Structure	PCC	m^3	12.63	11133.05
2		SSM footing	m^3	12.312	4249.25
3		Plinth Beam	m^3	8.208	25938.9
4	Super Structure	Brick work with masonry	m^3	33.47	141340
5		Parapet wall	m^3	4.256	17986.98
6		Roof two-way slab	m^3	8.89	27015.44
7		Lintel	m^3	0.552	881.33
8	Finishes	Putty	m^2	0.3987	1722.38
9		Cement plastering	m^2	2.658	4062.89
10		Flooring vertical tiles	m^3	0.5584	9348.11
11		Painting	m^2	312.33	10416
	TOTAL				254114.33

As the energy efficient building has embodied energy of 108330 MJ which can be read as 108.330 GJ, the building as the boundary of 57.76 m^2. From the above computations it was found that for materials the embodied energy of the building is 1.87 GJ/m^2.

VI. RAIN WATER HARVESTING DESIGN

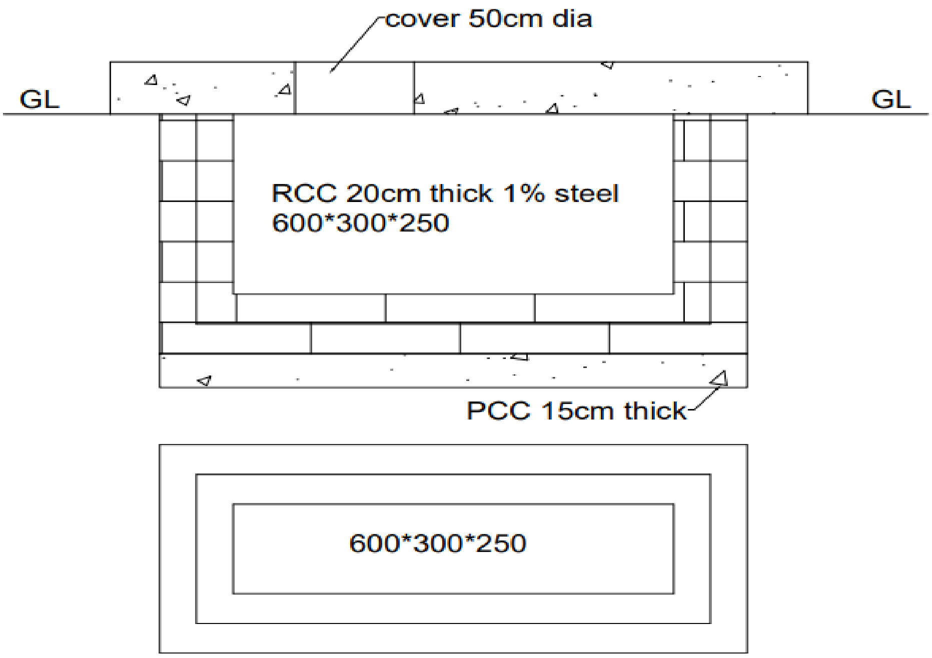

Fig 1: Plan of storage unit

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Area of catchment = 64m^2 Intensity of rainfall = I(mm)Run of coefficient = c
From central ground water board
Mysore district – 776.7mm average rainfallarea
Total rain water can be stored = 64*776.7*0.81
= 40264L = 40.264kl
Daily demand = 135l
For 4 members, 4*135=450L
Number of days = 40.264/540 = 74.56 days 20% of water demand can be collected and usedof nuclear family

VII. ELECTRICITY DEMAND

a. Monocrystalline silicon

The panel has the efficiency of 19% and has theself-life of 40years which can generate electricity of 125watts has output, each panel consumes 15sq.ft. The building has electricity demand of 100units per month that is same has100kW per month, on an average each day the electricity consumption of the nuclear family would be 3.33kW.

To attain the electricity demand which is generated from monocrystalline silicon panel the panel needs to be installed in 4units that would consume 60sq.ft, from the 4units of the panel the electricity output is 4.5kW.

were As the normal building has embodied energy of254114.33 MJ which can be read as 254.11433GJ, the building as the boundary of 57.76 m^2 from the above computations it was found that for materials the embodied energy of the building is 4.39 GJ/m^2.

1.17kW is generated is transmitted to electricityboard. The overall space required for monocrystalline silicon panel for buildingshown in fig-6.3 is 6.25m^2

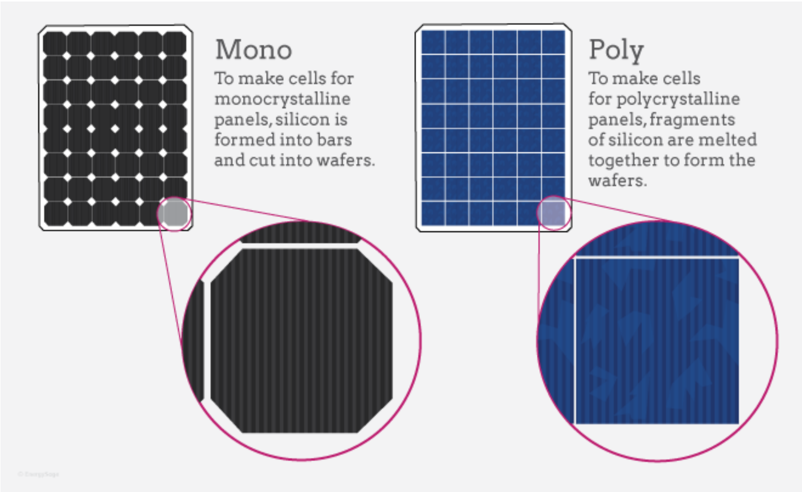

Fig 2: monocrystalline and polycrystallinesolar panel

b. Polycrystalline silicon

The panel has the efficiency of 13-16% and hasthe self-life of 25-30years which can generate electricity of 330watts has output, each panel consumes 80sq.ft. The building has electricity demand of 100units per month that is same has100kW per month, on an average each day the electricity consumption of the nuclear family would be 3.33kW.

To attain the electricity demand which is generated from polycrystalline silicon panel thepanel needs to be installed in 2units that wouldconsume 80sq.ft, from the 2units of the panel the electricity output is 5.9kW. were 2.61kW isgenerated is transmitted to electricity board.The overall space required for polycrystalline silicon panel for building shown in fig-6.3 is 7.56m^2.

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VIII. DEWATS SYSTEM

Decentralized wastewater systems (also referred to as decentralized wastewater treatment systems) convey, treat and dispose orreuse wastewater from small and low-density

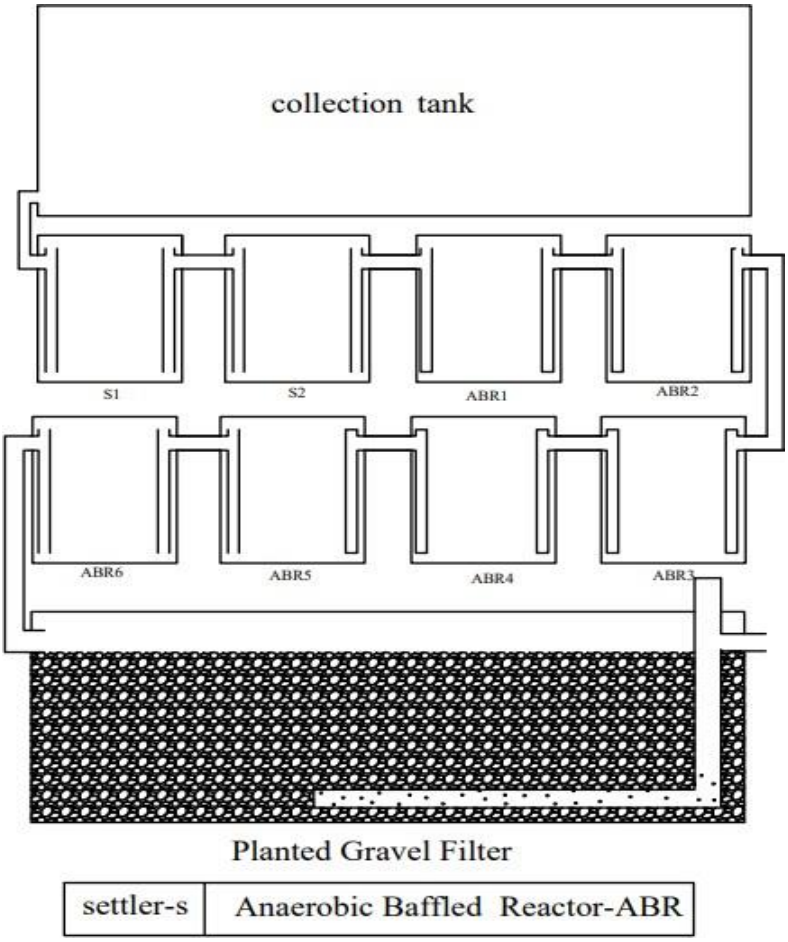

Fig 3: DEWATS system

IX. THERMAL ANALYSIS

Thermal Mass is defined as any building material having a high heat storage capacity that can be integrated into the structural fabric of the building to effectively utilize the passivesolar energy for the purposes of heating and cooling.

Fig 4: The temperature outside is 35.8 degreeCelsius and the room temperature is 29.8 degree Celsius

IARJSET

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communities, buildings and dwellings in remote areas, individual public or private properties. Wastewater flow is generated whenappropriate water supply is available within thebuildings or close to them. Treatment facilities resembling natural purification processes. Their application requires significant surface area, because of the slow pace of the biological processes applied. For the same reason they aremore suitable for warmer climates, because therate of the purification process is temperature dependent. These technologies are more resilient to fluctuating loads and do not requirecomplex maintenance and operation.

Fig 5: The temperature outside is 45.1 degreeCelsius and the room temperature is 30.2 degree Celsius

Some of the commonly used materials include concrete slabs, bricks, ceramic blocks, masonrywalls (concrete and bricks need a lot of heat to change its temperature but light weight thermalmass like timber have low thermal mass. The selection of a particular material to function as thermal mass depends on a variety of factorssuch as a high density, a high specific heat capacity and the ability to delay the time taken to release the heat Door - A door may be defined as open able barrier or as a framework of wood, steel, aluminium, glass or a combination of these materials secured in a wallopening.

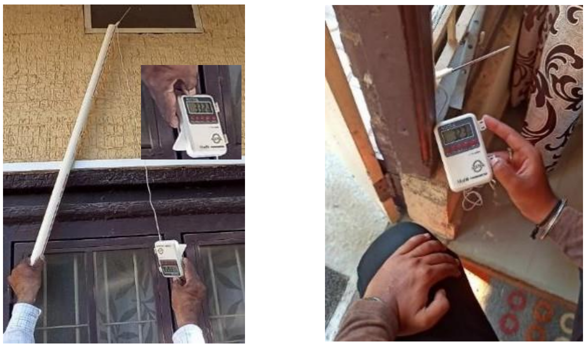

Fig 6: The room temperature is 32.3 degree Celsius and the temperature outside is 33.2 degree Celsius.

X. LIMITATIONS

- A restrain factor is the prevailing belief about the high cost of zero-energy efficientbuildings construction. However, calculations have shown that the cost of energy efficient buildings are only 8-10% higher than average cost of standard buildings, which is paid back within 10-15years due to the reduced operation costs.

- Industrial sludge incorporation is still a relatively new concept, hence long-termaspects like toxicity effects, endurance andtensile strength of the various constructionmaterials incorporated with industrial sludges are still in its juvenile stage. Further, experimentation and detailed analysis on fulfilment of strength criteria ofthe sludge incorporated concrete, remains aconspicuous lacuna in our project and is necessary in this arena prior practicability.

- The project aims to achieve a zero-energy building through few simple steps, and withthe collected data and results, a building ofgold LEED rating can only be achieved, asopposed to the platinum LEED rating required by that of a Zero Energy Building.Actual performance of zero energy buildings against net zero energy targets inthe current scenario in pre-design process isyet to be reviewed and evaluated.

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XI. CONCLUSION

In conclusion, Zero Energy Buildings (ZEBs) are a sustainable and energy-efficient building concept that aims to reduce energyconsumption and promote the use of renewableenergy sources. ZEBs are designed to produce as much energy as they consume, resulting in anet-zero energy balance. The implementation ofZEBs requires a holistic approach, including a combination of passive design strategies, energy-efficient technologies, and renewableenergy systems.

The benefits of ZEBs are numerous, including reduced carbon emissions, lower energy bills, improved indoor air quality, and increased occupant comfort. However, the initial construction costs of ZEBs can be higher than traditional buildings, and the implementation ofZEBs may face regulatory and technical challenges. Overall, ZEBs represent a significant step towards a more sustainable future, and their adoption can contribute to achieving global climate goals. As technologies and building codes continue to evolve, the implementation of ZEBs is expected to becomemore accessible and cost-effective in the future.The zero-energy building concept will help to reduce the Global warming and helps to retain the nature. In zero energy building using solar energy is the best energy source to save the energy and cost efficiency. The installation of solar panels initially will be costly, but as we know that it will reduce the energy consumption so the owner of the building in future, they can save money on their electricitybill. The solar panels that would be installed onthe back side of the building, which should be facing south.

A number of traditional approaches and future components are investigated along with their advantages and disadvantages. Currently, whilesome of these advances in envelope componenttechnologies are easy and cost effective to adopt, others still remain in the research and development phase for future applicability. Several studies have been performed to find theeconomic feasibility of various building energyefficiency strategies. Energy efficiency approaches sometimes might not require additional capital investment.

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