Design of Solar panel for Rizvi Educational Complex

Shaikh Munir Ali Vazid Ali[1], Shaikh Imran Abdul Raheem[2], Mansuri Jaid Mushtaq[3], Ansari Saniya Shabbir Ahemad[4], Dr. Varsha Shah[5], Suresh Suryawanshi[6]
[1,2,3,4]*Rizvi College of Engineering*
[5]*Principal, Rizvi College of Engineering*
[6]*Assistant Prof., Rizvi College of Engineering*

Abstract **- It started with review the historical data of energy consumption which can be compiled from the electricity bills. These data are important in order to understand the patterns of energy used and their trend. After obtaining the information on energy consumption, the next step is to set up an energy audit survey. this survey gives an information on present energy used. The energy utilization such as running hours of air-conditioning, lighting levels, locations of unnecessary air-conditioning and lighting due to unoccupied areas, temperature and humidity, chillers scheduling and setting, efficiencies of equipment's and machine and the areas of high energy consumption and the possibility to reduce consumption and renewable energy resources should be record for further analysis. In renewable energy resources we are moving toward the solar energy, wind energy and hybrid resources which can be easily installed in all buildings of whole Rizvi Educational Complex.**

We are going to select these resources based on their initial cost, area requirement, power generation, annual profit, maintenance cost, payback period. For selecting renewable energy resources based on those factors we are going to work with Analytical Hierarchy Process (AHP). It provides a comprehensive and rational framework for structuring a decision problem. The base of AHP is comparing variables by pair wise by Matrix relationship. In this way, pair wise of the effective variables give an alternative solution.

1.INTRODUCTION

This project is the vision to make Rizvi college energy efficient and motivate the campus to implement Renewable Energy Sources. It is a fact that this campus uses huge amount of energy and it's obvious that we are using huge amount of energy, and there are chances that some of the energy is being wasted somewhere in considerable amount. The purpose of the project is to conserve or generate the energy by selecting the appropriate methods and considering the following parameters.

Parameters: -

1. Initial Cost
2. Power Generated
3. Area Required
4. Maintenance Cost
5. Payback Period

Rizvi college uses a huge amount of energy around 1,60,000 to 1,70,000 units and it is also very obvious that we waste quite a sizable chunk of it.

Rizvi college energy bill keeps up around INR 8-10 lakh per month. This amount is huge and thus naturally attracts attention, we understand that quite a lot of energy is being wasted, which in return would mean that huge amounts of financial resources are being used.

Making the Rizvi college energy efficient will not only help the institute to reduce its expenses but also helps us fulfill our moral responsibility of not wasting this precious resource, which is scarcely available to rest of the people of the country.

Rizvi college is situated at Bandra where sometimes we face electricity cut off and on somedays electricity is not available for 24/7 in order to tackle these problems and as a technical institute, we should implement Renewable Energy Sources which will helps us to deal with the electricity shortage and will make the initiative towards "Green Campus".

Alongside major improvements in energy efficiency and energy conversion, the extensive use of renewable energy sources such as solar and wind will make a major contribution to future sustainable energy systems.

This would act as a prototype project, the lessons learnt here can be put to practice to make Rizvi college energy efficient and motivate the campus to implement renewable energy resources. As Rizvi

College have a good accessible space and have conspicuous energy wastage that can be reduced the implementation of renewable energy resource (Solar panels) is possible.
We are confident that the results that will come out of this exercise are bound to be of interest to everyone and can be the first step to make Rizvi College energetically not only the most efficient campus but also Green Campus in India.

Solar Energy
Solar power in India is a fast-growing industry. As of 28 February 2017, the country's solar grid had a cumulative capacity of 9.57 gigawatts (GW). In January 2015, the Indian government expanded its solar plans, targeting US $100 billion of investment and 100 GW of solar capacity, including 40 GW from rooftop solar, by 2022. Commenting on the key importance India attaches to solar power, India's Prime Minister Narendra Modi said at the historic COP21 climate conference in Paris last year. "The world must turn to (the) sun to power our future. As the developing world lifts billions of people into prosperity, our hope for a sustainable planet rests on a bold, global initiative. India's initiative of 100 GW of solar energy by 2022 is an ambitious target given the world's installed solar power capacity in 2014 was 181 GW. India quadrupled its solar power generation capacity from 2,650 MW on 26 May 2014 to 10,000 MW on 10 March 2017. The country added 4 GW of solar power capacity in 2016, the highest of any year.

Energy Audit
Energy Audit is the key to a systematic approach for decision-making in the area of energy management. It attempts to balance the total energy inputs with its use and serves to identify all the energy streams in a facility. It quantifies energy usage according to its discrete functions. Industrial energy audit is an effective tool in defining and pursuing comprehensive energy management program.
As per the Energy Conservation Act, 2001, Energy Audit is defined as "the verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption".

2. OBJECTIVES

The objective of this project is to make Rizvi College energy efficient and motivate the campus to implement Renewable Energy Sources.
In order to reach to our main objective, following objectives should be considered:

- Conduct Energy Audit at Rizvi College, in order to acquire and analyze data and finding the energy consumption of these facilities.
- Calculate the wastage pattern based on the results of the above objective.
- Suggest feasible methods in order to conserve energy and reduce electricity bill.
  For example: Use of Energy Efficient Appliances.
- Conduct survey at Rizvi College to find out feasible Renewable energy resources for our Campus.
- Forming number of permutation and combination of Renewable energy resources keeping budget in mind.
- Use of AHP (Analytical Hierarchy Process) @ tool to select best suited Renewable energy resources for our campus.
- Suggest the institute for implementation.

3. LITERATURE REVIEW

Sopian et al (1996) developed a steady state model for comparison of the performance of single and double pass PV/T air collectors in which they concluded that double pass collectors performed better for the reason that it resulted in cooling of the solar cells and reduction of front cover temperature. Bergene and Lovvik (1995) proposed a detailed physical model of a flat plate PVT water collector and investigated the fin width to tube diameter ratio and
found that the total efficiency was in the range of 60-80%.
Fujisawa and Tani (1997) on conducting an exergy analysis on uncovered and single covered design indicated that exergy output density of unglazed collector was much higher than single cover design for the reason that thermal energy contains much unavailable energy. Harbi et al (1998) conducted experiments in Saudi Arabia and found that high ambient temperatures in summer resulted in 30% drop in efficiency in spite of good thermal efficiency, whereas in winter months the PV performance was

better when compared to the thermal performance which deteriorated.

Tripanagnostopoulous et al (2002) conducted outdoor tests on PV/T collectors of both air and water type with different collector configurations for horizontal mounted applications. They found that the manufacturing cost of PV/T air collectors are 5% higher than the PV modules separately, PV/T water collectors with poly crystalline Silicon cells costs 8% more than the conventional PV modules. It was also suggested that collectors must be placed in parallel rows to avoid shading and low-cost booster diffuse reflectors can be kept to increase radiation received on collector surface.

4. METHOD AND METHODOLOGY

Physical Survey of Campus

As a first step in this regard, a group of 4 students were split into two teams each team was assigned a particular area or application of energy in the campus and note down all data's regarding energy consumption appliances which is used in daily basis and form the general layout for entering all data which is required for Energy Audit.

Following parameters are considered for Energy Audit:

1. Appliances and their consumption in terms of Wattage.
2. Quantity
3. Hours of use

Team 1: Data Collection

Team 2: Data analysis and data logging

This table gives the information how much energy consumed by each floor of Rizvi Educational Complex.

Table 4.1 Engineering Building

Floor	Wattage Per Day
Ground Floor	1600000
First Floor	1000000
Second Floor	1000000
Third Floor	700000
Fourth Floor	700000
Fifth Floor	670000
Total Consumption (w-hr.)	5670000
No. of Units	5670
Total no. of Units per Month	170000

Table 4.2 Total Number of Units of Rizvi Educational Complex

Building	Total Number of Units Per Month
Engineering	170000

Survey for Area

Site Selection for Solar Energy

During the survey, we found that the terrace of Rizvi building has the potential for installation of Solar Panels or Solar Energy. Since the terrace area have only water tanks accompanied by the availability of good empty space. It would be beneficial for the campus to use terrace area.

The terrace area of Engineering building is shown below:

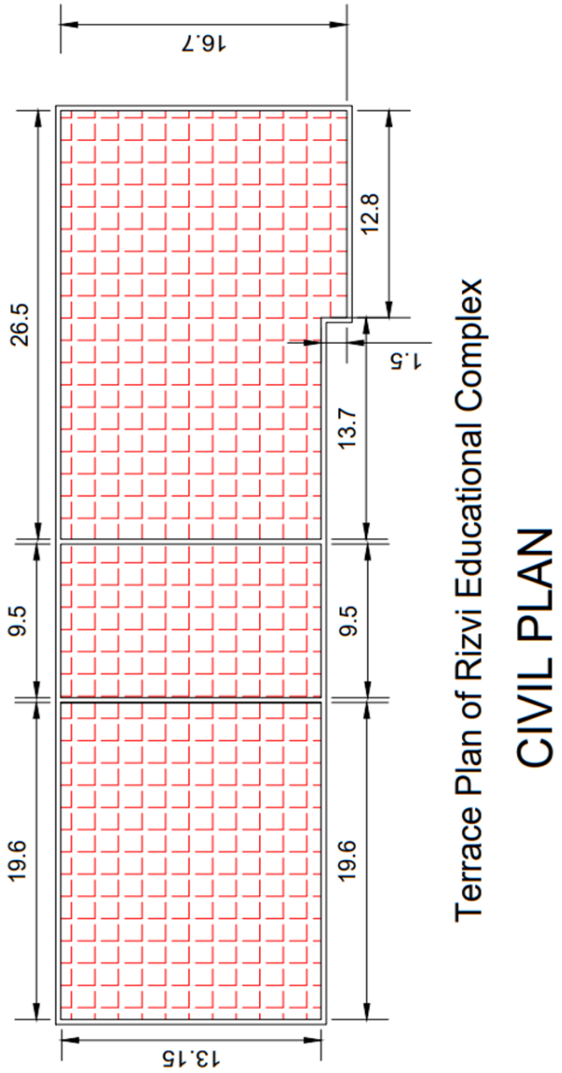

Fig. 4.1 Measurement Plan of Engineering Building

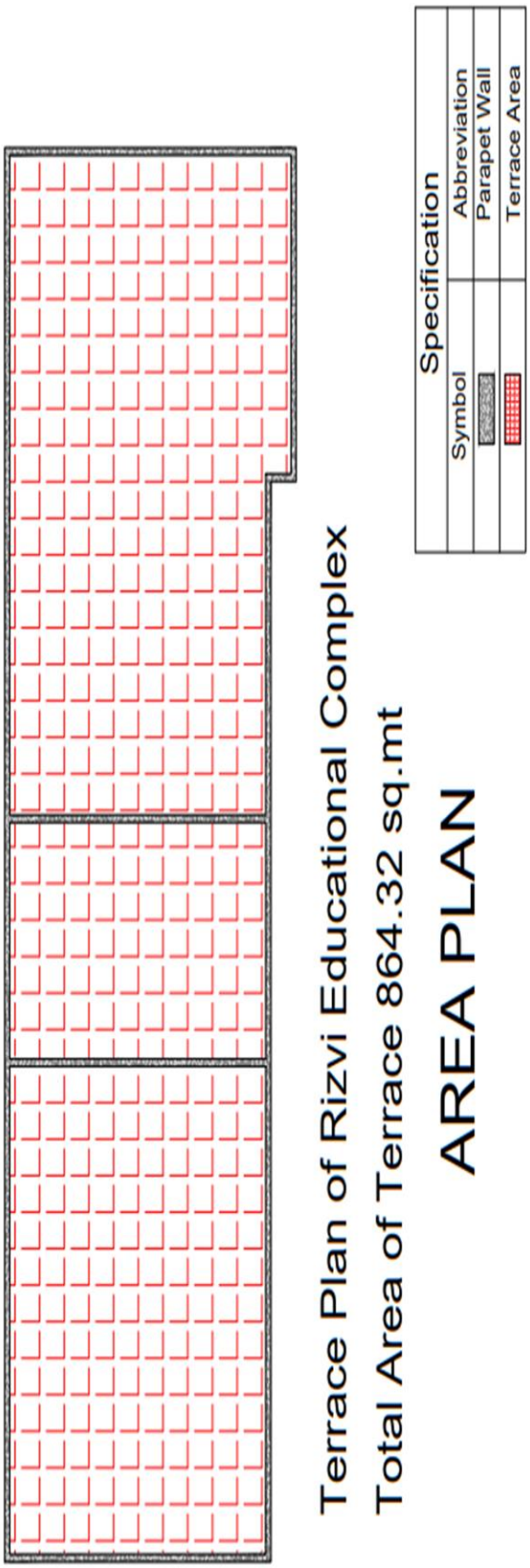

Fig. 4.2 Terrace Areas of Engineering Building

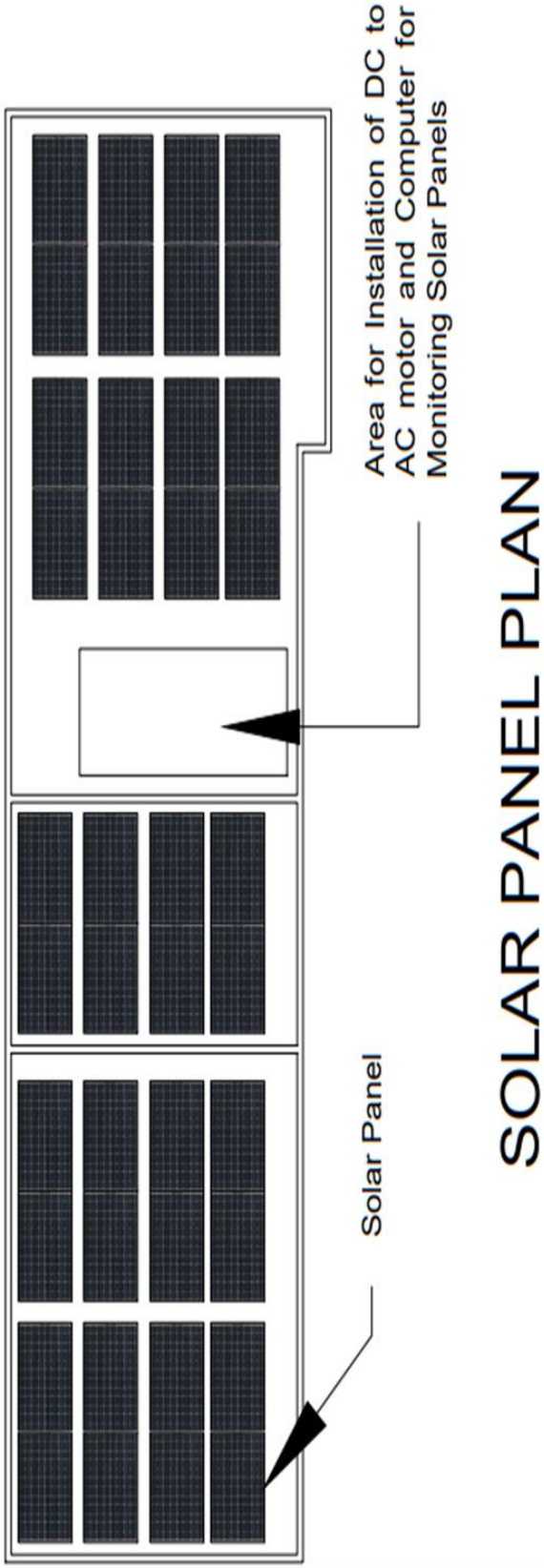

Fig. 4.3 Solar Panel Arrangement for Engineering Building

5. DESIGN OF SOLAR PANEL

Total Electricity used per day
(watts) = 4772240
Monthly days = 25
Monthly used = 4772240 X 25 = 119306000 (watts)
Per kw rate = 5.5 Rs
Monthly bill paid by college = 119306X5.5 = 656183 Rs
Yearly pay = 12X656183 = 78,74,196 Rs
Per day required energy = 4800 kw
10 kw solar panel system minimum energy per hour = 30 kw
Minimum hours or sun light = 8
Monthly days = 30
Per day solar energy by one solar system = 30X8 = 240
Number of solar system required = 4800 / 240 = 20
Monthly provided energy by solar system = 20X240X30 = 144000 kw
One system amount = 5,70,000 Rs
Total amount of solar system = 20X570000
= 11,400,000 Rs
Number of year required for amount recovery = 11,400,000 /78,74,196 = 1.4477 years
Number of years = 1.5 year
Monthly extra power available
= 144000 – 119306 = 24694 kw
Soled amount per kw = 5 Rs
Total soled amount = 24694X5 = 1,23,470 Rs

Output from Solar Panel

1. Monthly Energy Provided by Solar Panel = 1,44,000 Kw
2. Yearly Energy Provided by Solar panel= 17,28,000 Kw
3. Monthly Energy Saved = 24,694 Kw
4. Yearly Energy Saved= 2,96,328 Kw
5. Monthly Amount Earned = 1,23,470 Rs/-
6. Yearly Amount Earned = 1,48,1640 Rs/-
7. Total Cost of Solar = 11,400,000 Rs/-
8. Period of Recovery= 1.5 years

6. RESULT

1. Monthly Energy Used by Rizvi educational complex = 1,19,306 Kw
2. Monthly Amount to be Paid Rs 5.5/Kw = 1,19,306×5.5=6,56,183 Rs/-
3. Yearly Energy Used by Rizvi educational complex = 1,19,306×12= 14,31,672 Kw
4. Yearly Amount to be Paid= 78,74,196 Rs/-

6. FUTURE SCOPE

1. This is an inexhaustible source of energy and the best replacement to other nonrenewable energies in India.
2. Solar energy is environment friendly. When in use, it does not release CO2 and other gases which pollute the air. Hence, it is very suitable for India, India being one of the most polluted countries of the world.
3. Solar energy can be used for variety of purposes like as heating, drying, cooking or electricity, which is suitable for the rural areas in India. It can also be used in cars, planes, large power boats, satellites, calculators and many more such items, just apt for the urban population.
4. Solar power is inexhaustible. In an energy deficient country like India, where power generation is costly, solar energy is the best alternate means of power generation.
5. You don’t need a power or gas grid to get solar energy. A solar energy system can be installed anywhere. Solar panels can be easily placed in houses. Hence, it is quite inexpensive compared to other sources of energy.

7. CONCLUSION

1. At this time, the mankind is trying to re-establish the connection it once had with nature. An energy efficient Rizvi College campus will be a personal step towards the direction of renewable energy, environmental protection, and sustainable living. Having such a campus will result into reduction of bills and provides an excellent investment. Furthermore, energy efficiency means healthier and more comfortable living that is in line with nature.
2. If you want to start saving money now, protect your health and the environment, do not hesitate to apply what this guide has taught you. Create a comfortable energy efficient campus and join the quickly approaching future of energy sustainability. Energy security have led to increasing interest and more development in

renewable energy sources such as solar, wind and hybrid giving us clean, reusable energy to power our world.

3. The use of this energy is free, does not create pollution, having a backup system in case of a local or widespread power outage, and if used wisely can help us become less dependent on other costlier and damaging forms of power. After participating in this we hope you are able to see the benefits of this valuable resource and help change the future for energy use.

Table 7.1 Comparison

Conventional Energy used by Rizvi educational complex	Solar Energy provided by solar panels to Rizvi educational complex
Energy used by Rizvi Education Complex in a month - 1,19,306 KW.	Energy provided by solar panel in a month- 1,44,000 KW.
Energy used by education complex in a year - 14,31,672 KW	Energy provided by Solar panel in a year - 17,28,000 KW
Amount paid by Rizvi Education Complex every year – Rs.78,74,196/-	Amount invested by education complex – 1,14,00,000/-
Conventional energy is provided by government i.e., we are dependent on government.	Solar energy can be produced privately by installing panels i.e., we are independent.
Conventional energy is produced by coal, nuclear, petroleum etc. which leads to pollution, hence it is harmful to nature.	Solar plants produce electricity by concentrating solar energy which is clean and nonpolluting. Hence it is ecofriendly.
We have to pay for conventional energy.	Solar Energy can be supplied to others and earn money.

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