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International
Journal
Of Modern Engineering Research (IJMER)

Planning and Designing a Stand Alone Solar Power System for Multi-Building Organization

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Abstract: *The purpose of this project is to discover ways to produce energy with alternate sources. This presents current status, major achievements and future aspects of solar energy in India and evaluation of current energy policies for conquering the obstructions and implementing solar for the future is also been presented. Solar energy is expected to play a very significant role in the future especially in developing countries, but it has also potential prospects for developed countries. Solar radiation is an integral part of different renewable energy resources like PV power, solar thermal power, solar heater etc.*

This consists of Study of the Solar cell, Solar Photovoltaic Technology, ***Planning and Designing a Stand Alone Solar Power System for Multi Building in an Organization*** *where Solar energy plays an important role for the power supply in case of emergency by replacing Diesel Generator set i.e. DG Set.*

This gives a detail planning and designing of solar power system of 80KW demand per hour for Al-Falah School of engineering and technology, Brown hills college of engineering and technology, central canteen, masjid, Hostel as well as Al-Falah School of Training and Education.

Keywords: *MNRE, SP, DG Set.*

I. Introduction

A small solar electric or photovoltaic (PV) system can be a reliable and pollution-free producer of electricity for your home or office. Small PV systems also provide a cost-effective power supply in locations where it is expensive or impossible to send electricity through conventional power lines. A significant part of the large potential of solar energy in the country could be developed by promoting grid interactive solar
Photo voltaic power systems of varying sizes as per the need and affordability coupled with ensuring adequate return on investment. It has been proposed to set up a 80KW stand alone Power System plant on the roof top terrace of the north wing of Al-Falah Group of institution as a pilot project.

1.1 The SPV system at roof-top of Al-Falah Group of Institution, is estimated to provide annual Energy generation of 49290 KW/annum and operate at a capacity factor of 19%.

1.2 If I consider 265 days per annum sunshine days then the total load or backup power provided in this case/Thesis

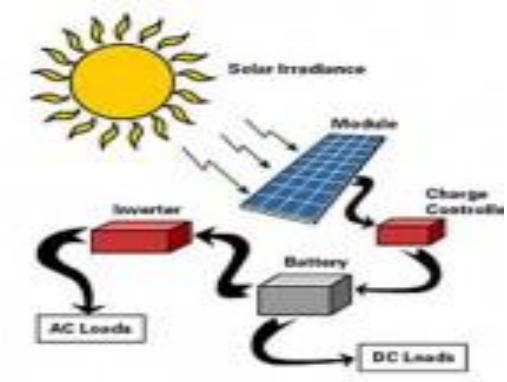

Fig.1.1. Electricity generated by photovoltaic cell

1.3 The primary objective of the solar energy research enclave will be two-fold:-

a) Establishment of a solar power station that can supply 80 KW/hr power
b) Outline the research areas that will be explored for sustainable solar energy generation, storage and distribution.

The solar power station will be built in modular fashion such that different technologies can be utilized/tested for generating power. The modules will be designed not only as a demonstrator of existing technologies but also to explore cutting edge research Technologies that have potential for economic viability.

II. Background Related Work

To Study the various journal papers such as Elsevier, IEEE, Science direct, international & national conferences. Finally study the paper of solar power plant on rooftop connected status of solar energy in India and global, solar energy tariff, renewable energy policy of different states in India. About these papers short conclude and explanations are given below in the literature survey.

This chapter gives review of literature of different papers related our search. In this section the study of various papers and thoughts authors regarding **"A Stand Alone Power System for Al-Falah Group of Institution"** is proposed which helps in defining the objective.

The solar photovoltaic device systems for power generation had been deployed in the various parts in the country for electrification where the grid connectivity is either not feasible or not cost effective as also some times in conjunction with diesel based generating stations in isolated places, communication transmitters at remote locations. With the downward trend in the cost of solar energy and appreciation for the need for development of solar power, solar power projects have recently been implemented. A significant part of the large potential of solar energy in the country could be developed by promoting grid interactive solar photovoltaic power systems of varying sizes as per the need and affordability coupled with ensuring adequate return on investment.

III. Presentation Of The Main Contribution Of The Paper/ Scope Of Research

SOLAR power has always had a reputation for being expensive, but not for much longer. In India, electricity from solar is now cheaper than that from diesel generators. The news - which will boost India's "Solar Mission" to install 20,000 megawatts of solar power by 2022 - could have implications for other developing nations too.

Recent figures from market analysts Bloomberg New Energy Finance (BNEF)show that the price of solar panels fell by almost 50 per cent in 2011. They are now just one-quarter of what they were in 2008. That makes them a cost-effective option for many people in developing countries.

A quarter of people in India do not have access to electricity, according to the International Energy Agency's 2011 World Energy Outlook report. Those who are connected to the national grid experience frequent blackouts. To cope, many homes and factories install diesel generators. But this comes at a cost. Not only does burning diesel produce carbon dioxide, contributing to climate change, the fumes produced have been linked to health problems from respiratory and heart disease to cancer.

Now the generators could be on their way out. In India, electricity from solar supplied to the grid has fallen to just 8.78 rupees per kilowatt-hour compared with 17 rupees for diesel. The drop has little to do with improvements in the notoriously poor efficiency of solar panels: industrial panels still only convert15 to 18 per cent of the energy they receive into electricity. But they are now much cheaper to produce, so inefficiency is no longer a major sticking point.

The one thing stopping households buying a solar panel is the initial cost, says Amit Kumar, director of energy-environment technology development at The Energy and Resources Institute in New Delhi, India. Buying a solar panel is more expensive than buying a diesel generator, but according to Chase's calculations solar becomes cheaper than diesel after seven years. The panels last 25years.

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IV. Proposed Methodology And Discussion

	PV Crystalline	PV - Concentrators	PV – Thin Film	Total
Capacity (kW)	300	100	100	500
Expected Power Generation per year #	443644	184723	147880	776247
Value if consumed by IITK (per year)	443644*3.3 =Rs. 13.31 Lakh	184723*3.3 = Rs. 6.1 Lakh	147880*3.3 = Rs. 4.44 Lakh	Rs. 23.85 Lakh
Value if sold to Grid (per year)@	443644*11.4 Rs. 50.6 Lakh	184723*11.4 Rs. 21.06 Lakh	147880*11.4 = Rs. 16.86 Lakh	Rs. 88.49 Lakh
	Table no.4.1 Pricing			
Additional Benefits due to CDM Credits				

Basic Principles to Follow When Designing a Quality PV System

- Select a packaged system that meets the owner's needs. Customer criteria for a system may include reduction in monthly electricity bill, environmental benefits, desire for backup power, initial budget constraints, etc. Size and orient the PV array to provide the expected electrical power and energy.
- Ensure the roof area or other installation site is capable of handling the desired system size.
- Specify sunlight and weather resistant materials for all outdoor equipment.
- Locate the array to minimize shading from foliage, vent pipes, and adjacent structures.
- Design the system in compliance with all applicable building and electrical codes.
- Design the system with a minimum of electrical losses due to wiring, fuses, switches, and inverters.
- Properly house and manage the battery system, should batteries be required.
- Ensure the design meets local utility interconnection requirements.

Basic Steps to Follow When Installing a PV System

- Ensure the roof area or other installation site is capable of handling the desired system size.
- If roof mounted, verify that the roof is capable of handling additional weight of PV system. Augment roof structure as necessary.
- Properly seal any roof penetrations with roofing industry approved sealing methods.
- Install equipment according to manufacturer’s specifications, using installation requirements and procedures from the manufacturers' specifications.
- Properly ground the system parts to reduce the threat of shock hazards and induced surges.
- Check for proper PV system operation by following the checkout procedures on the PV System Installation Checklist.
- Ensure the design meets local utility interconnection requirements
- Have final inspections completed by the Authority Having Jurisdiction (AHJ) and the utility (if required).

V. Result

80 kW Solar Power Plant with the optimum quality components and the latest Computer/Mobile data monitoring system would cost a total of Rs. 88,00,000/- approximately.

The main components and accessories covered within the cost are mentioned as under:

1. PV modules: 350 Nos. approx. of 250W each
2. Inverters with total capacity of 100 KVA approx.
3. G.I. mounting structures and frames for modules.
4. Isolation Transformer.
5. Mobile phone/Computer data monitoring system.
6. MCBs.
7. SPDs (Surge Protection Devices).
8. Energy Meter.
9. Distribution boxes.
10. Lightening arrestors.

11. Cables, Wires and other accessories.
12. Supply, Installation, Testing and Commissioning.
13. Free Maintenance for a period of one year after commissioning.

A. Total cost of project:- Rs 88,00,000/ approx.
B. Subsidiary provided by Govt. of India under JNNSM @ 30% of total project cost then it become:- Rs 2640000/approx.
C. Total budget of the project became:- (A-B)= 6160000/approx

5.1 COST FEASIBILITY OF EXITING DG SET

Al-Falah Group of Institution has already set-up three DG set the detail are as following:-

Sl. no	Company name	Rating in KVA	Cost in Rs
01	**Cummins**	**82.50**	**4,40,000**
02	**Kirloskar**	**180**	**5,40,000**
03	**Caterpillar**	**320**	**10,00,000**
	Total		**19,80,000**

5.2 Equation become:-

(i) Fuel consumption @75% load with Radiator & Fan= 51.1 ltr/hr @ 320 KVA
(ii) Cost of Fuel per KVA became= 51.1/320 = 0.159 ltr/KVA 0.16 ltr/KVA
(iii) Now we have to design the load of 80 KW emergency load i.e. (100 KVA)
(iv) Cost for 8 hrs will become= 0.16*100

= 16 ltr *Rs 53 per ltr.
= Rs 6800/day (8 hrs)

The Annual cost of diesel from the above system become= Rs 24,48,000
The cost of Solar power system for 100 KVA calculated= Rs 61,60,000

Pay Back Period

The Annual cost of diesel from the above system become= Rs 24,48,000
The cost of Solar power system for 100 KVA calculated= Rs 61,60,000

Rs 6160000/2448000= 2 years 6 month and 6 days

Life cycle of the system is up to 25 Year

The cost of the installation of solar system will be recover in Two an half Years and after that there will be relief/saving of Rs 2448000. If the maintence is also included in the system, certainly the amount will be recovered in three year in all respect. If there is no power failure from the utility or in the night hour, the use of solar system can be done frequently after shunting of utility supply.

VI. Conclusions

Solar power is a good alternative energy source. It has many advantages over fossil fuels. One is that the sunlight is free of cost and does not have to be bought like other fuels. It also doesn't hurt the environment and it is a renewable energy source. There are a few drawbacks to solar power. One is that it can be expensive to installation/Setup and can be hard to use on cloudy days. Solar power is also difficult and expensive to store. Another demerit is that silicon material be use for manufacturing of solar cell is not readily available.
At the last, the project or thesis able to find out whether the planning and designing of solar power system is economical. This is very unfortunate because solar power would be far more advanced with more funding. 30 per cent central government able to provide subsidiary. Out of total cost of installation. One of the most important thing is eco-friendly and pollution free. Once installed upto 25 years.

Acknowledgement

First and foremost, I would like to thank the almighty GOD for providing me the chance to work in such a prestigious institute under supervision of eminent teachers. The subject of this Dissertation was suggested by my supervisor, Muhammad Ilyas (Asst.Prof.) to whom I would like to express my heartfelt thanks for his

supervision, guidance, as well as Mr. J.K. Garg (Associate Prof.) Co-guide encouragements and extremely useful suggestions throughout this Dissertation. It has been a great honor to have Mr. Muhammad Ilyas as supervisor and Mr. J.K. Garg Co-guide

I would like to thank Prof. Aziz Ahmad (HOD) who has made any necessary changes in the Dissertation with remarkable patience and provided the parameters used in the Dissertation. I would like to say a special thank you to Mr. J.K. Garg for his valuable advices and strong technical support. Their continuous support helped me to finish this Dissertation. I wish to thank Al-Falah School of Engineering and Technology supports during the preparation of this Dissertation. I wish also to extend my acknowledgements to all staff members in the department and my friends. Finally, I would like to thank my family for their endless support and encouragements.

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