iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** IV **Month of publication:** April 2023

DOI: https://doi.org/10.22214/ijraset.2023.51144

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IV Apr 2023- Available at www.ijraset.com

The Canal Top Solar Power Generation Project

Neha Sananse[1], Snehal Povekar[2], Anjali Wagh[3], Sayali Donde[4], Keerthi Gurani[5], N. V. Khadake[6]
[1, 2, 3, 4]*Research Scholar,* [5]*Assistant Prof,* [6]*Prof. & Head, Civil Engineering Department, JSPM's Imperial College of Engineering and Research, Pune*

Abstract: ***Solar energy is one of the most abundant sources of renewable energy for the future. This solar energy can be uprooted by PV system. Negative environmental impact of reactionary energy consumption highlights the part of renewable energy sources and give them a unique occasion to grow and ameliorate. Among renewable energy sources solar energy attract further attention and numerous studies have concentrated on using solar energy for electricity generation. Then, in this study, solar energy technologies are reviewed to find out the stylish option for electricity generation. Using solar energy to induce electricity can be done either directly and laterally. In the direct system, PV modules are employed to convert solar irradiation into electricity. In the circular system, thermal energy is exercised employing concentrated solar power (CSP) shops similar as Linear Fresnel collectors and parabolic trough collectors. In this design electricity generation in Pune from solar energy by furnishing solar panels on top of conduit is bandied. And we prepare model for the design in Pune. We also bandied about the developments in Pune due to this solar power design and how the electricity is distributed in Pune and how the conduit water is used for agrarian purposes. This solar power generation from the top face of conduit design has several benefits similar as16.2 million units of power generated annually, 90 million liters of water is conserved annually, 25 acres of land conserved, lower algae growth in the conduit water, minimize evaporation from conduit, produce Eco-friendly power using solar panels as a cover and save land.***

Keywords: Photovoltaic cells, concentrating PV (CPV), Photovoltaic, Solar panel cooling, Hydraulic canal, Solar panel temperature.

I. INTRODUCTION

Due to the increase in world population, development in industrial activities, and enhancement in living standards, the human demand for electricity will grow in the future years. Traditional fossil fuels such as oil and coal cause carbon dioxide emissions and global warming. Thus, it is necessary to explore appropriate alternatives sources for electricity generation which are environmentally benign and sustainable. Solar energy is one of the most attractive sources of energy for electricity generation. Typically, solar energy harnessed in the daytime needs to be stored (thermally or electrically) for utilization in the night. Utilizing energy storage units often entails higher up-front and ongoing expenses, which raises the overall cost of power produced. Recent improvements in solar energy research and development have made solar energy systems more accessible to businesses. Research is still being done to reduce the costs and technical limitations of the systems that are generally used in solar power plants.

According to a recent International Energy Agency (IEA) report, fossil fuels account for 82% of the world's energy consumption. However, by 2035, it is expected that by creating new renewable energy sources or making improvements to the existing renewable energy systems, this share will drop to 75% by creating new renewable energy sources or enhancing the existing renewable energy systems by 2035. Since the rate of solar energy falling to the planet's surface is 120 105 watts, the energy received by the earth from the sun in a one day can supply all the world's energy needs for more than 20 years.

Since solar energy is an import-independent energy source, development in solar energy infrastructures can increase the level of energy security. Additionally, using solar energy has little influence on the environment.

II. OBJECTIVES

1) Model Preparation to generate the electricity.
2) Facilitate simple electricity generation.
3) Solar energy is produced without pollution using solar modules.
4) You can use the electricity produced by a solar power plant when there is no power.

III. LITRATURE REVIEW

Samuel et.al (2019) where reported that awareness and use of solar energy as alternative power sources for ICT facilities in Nigerian university libraries and information centers.

This paper reports a survey carried out to investigate the awareness and use of solar energy as alternative power source for ICT facilities in Nigerian library and information centers. Descriptive research design using survey method was adopted for this study. Finally, this study concludes that all the respondents have good knowledge of what solar energy is as they all responded in affirmative.

Ehsanul Kabir et.al (2018) where stated that Solar energy: potential and prospects. In this article the merits and demerits of solar energy technologies are both discussed. Several technical problems affecting renewable energy research are also highlighted, along with beneficial interactions between regulation policy frame works and their prospects. For that they provide a global scenario about solar energy technologies in terms of their potential, present capacity, prospects, limitations, and policies.

Suhas bannur (2018) where stated that concentrated solar power in India: current status, challenges, and outlook. In this article, some of the challenges that have inhibited the growth concentrated solar power are identified and possible solutions suggested. The critical challenges for CSP are related to the lack of reliable direct normal irradiance database, indigenous manufacturing, and competition from PV.

Jean Baptiste et.al (2018) where reported that review of the solar energy situation in Rwanda and Uganda. In this paper authors review the solar energy development and future in Rwanda and Uganda. In these two countries, solar energy sector plays an important role in supporting socio-economic development.

Mohd Rizwan et.al (2017) where stated that a review paper on electricity generation from solar energy. In this article authors reviewed about the solar energy from sunlight and discussed about their future trends and aspects.

Gangopadhyay et.al (2016) where stated that Wind and solar energy for reducing electricity deficits in Karnataka. In this article the main objective of the authors is to estimate the contributions that wind and solar power could make in reducing expected power deficits in a future year, given the conventional generation that has been planned.

Shubojit Dawn (2016) where stated that analysed the recent trends in the development of solar energy in India. The study proposes that climate change and its consequences of natural disasters are mainly due to increased rate of corban emissions and its outcomes associated with greenhouse effect.

Jaymin Gajjar et.al (2015) where reported that Solar PV energy generation map Karnataka, India. This study deals with solar photo voltaic generation potential for the Karnataka state. Both annual energy generation and month wise energy generation maps are prepared. The simulation results are closely matching with the actual energy generation data of existing power plants.

M.A. Bou Rabee et.al (2015**)** where reported that Characteristics of solar energy radiation on typical summer and winter days in Kuwait. In this work authors studied characteristic of solar energy radiation in Kuwait by measuring irradiance and comparing the data of selected time periods in two extreme seasons.

IV. MATERIAL AND METHODOLOGY

How solar power plant works?

The project components for a solar power plant include Solar PV array, transformer, inverter, substation, transmission line and shared infrastructures (office building, control room, guard room, etc.). Solar power is trapped through the PV cells in the modules, which are connected to form an array to produce higher voltage. Since the power generated through the solar panels is a Direct Current and electrical appliances use the Alternating Current, inverters are used to convert DC to AC generated in the solar farms. Transformers are then connected with the AC to step up the voltage to 33 kV for transmission to pooling substation and there it steps up 220 kV level to feed into the grid substation.

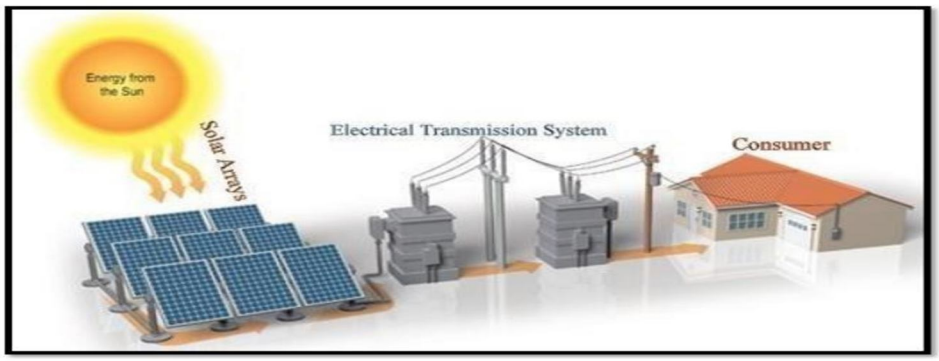


Figure 1. Working Solar Power Plant

Materials: The project components for a solar power plant include Solar PV array, transformer, inverter, substation, transmission line and shared infrastructures (office building, control room, guard room, etc.). Solar power is trapped through the PV cells in the modules, which are connected to form an array to produce higher voltage. Since the power generated through the solar panels is a Direct Current and electrical appliances use the Alternating Current, inverters are used to convert DC to AC generated in the solar farms. Transformers are then connected with the AC to step up the voltage to 33 kV for transmission to pooling substation and there it steps up 220 kV level to feed into the grid substation.

A. Solar PV Plants Components

1) Solar PV modules: These convert solar radiation directly into electricity through the photovoltaic effect in a silent and clean process that requires no moving parts. The PV effect is a semiconductor effect whereby solar radiation falling onto the semiconductor PV cells generates electron movement. The output from a solar PV cell is direct current electricity. A PV power plant contains many cells connected in modules and many modules connected in strings2 to produce the required DC power output.

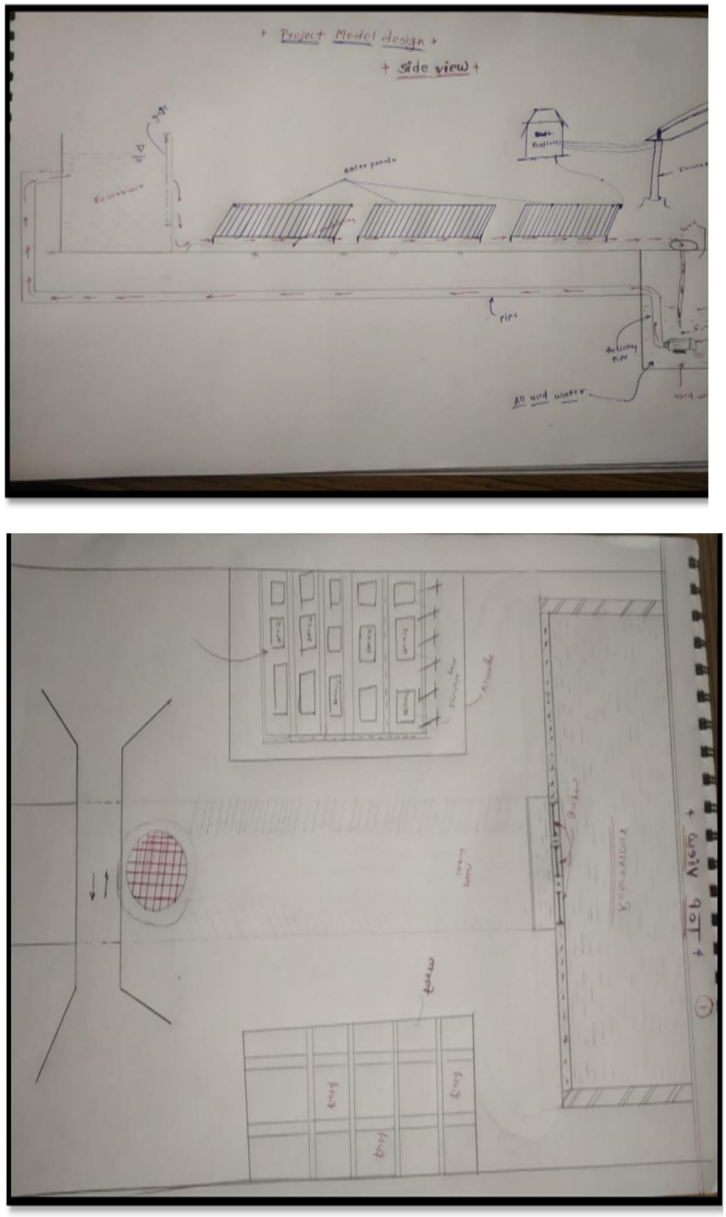


Figure 4. planned to prepare model for the same project in Gujarat.

2) *Inventers:* These are required to convert the DC electricity to alternating current (AC) for connection to the utility grid. Many modules in series strings and parallel strings are connected to the inverters.
3) *.Module Mounting Systems:* hese allow PV modules to be securely attached to the ground at a fixed tilt angle, or on sun tracking frames.
4) *Step-Up Transformers:* The output from the inverters generally requires a further step-up in voltage to reach the AC grid voltage level. The step-up transformer takes the output from the inverters to the required grid voltage (for example 33kV and 230 kV depending on the grid connection point and country standards).
5) *Grid Connection Interface:* This is where the electricity is exported into the grid network. The substation will also have the required grid interface switchgear such as circuit breakers (CBs) and disconnects for protection and isolation of the PV power plant, as well as metering equipment. The substation and metering point are often external to the PV power plant boundary.

B. Alternating Current Components

The AC subsystem commences from the output of the inverters and comprises of the transformers, the associated switchgear, metering, and protection circuits and terminates at the two-pole structure from where the transmission lines would start.

1) *Transformer:* Outdoor oil-type 6.40 MVA for String Inverter & 12.5 MVA for Central Inverter option with Voltage 33KV (as per design) with three winding for String Inverter and five winding for Central Inverter option will be used for the project.
2) *HT Panel:* The HT panel is an interface between the transformers and grid providing the protection required for the system. The switchgear contains all equipment viz. Circuit breakers, CTs, PTs, relays and associated equipment. 33 kV Switchgear with16 ITS station and 2 number for MCR will be used.
3) *Metering:* The metering arrangement is compatible with the Availability Based Tariff mechanism along with a check meter with Modbus arrangement and facility to provide remote monitoring. The meter has web communication facility and is visible at the State Load Dispatch Centre.
4) *AC Auxiliary Supply*: The AC auxiliary supply of single/three phase is required for periphery lighting, security cabin and control room lighting etc.

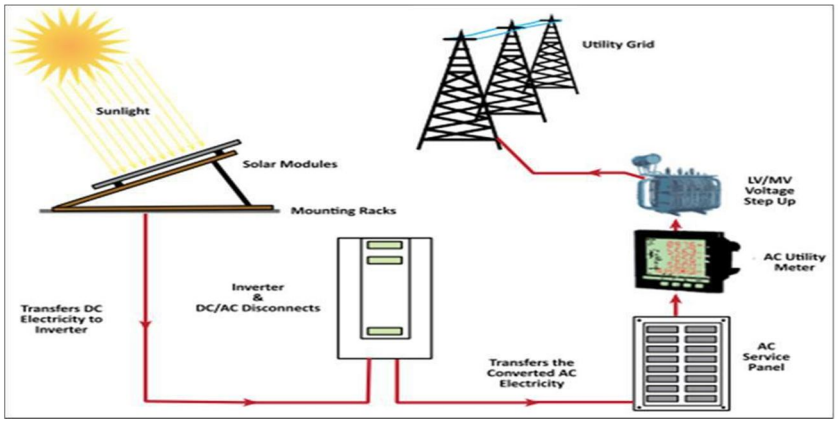


Figure 3. Solar PV Plants Components

C. Solar Design

1) *Photovoltaic:* Semiconductor devices that convert sunlight directly into electricity are called photovoltaic material. Semiconductors convert photons to electrical voltage. The process has no moving parts and does not produce any pollution or noise. PV panels must be placed in unshaded locations and are better efficient in hot weather conditions of Multan. Technological limitations, ambient heat, alignment with the sun and shading of panels due to extreme weather reduces PV panels efficiency. In canal top PV system, efficiency and power production of panels will increase due to cooling effect of canal.
2) *Crystalline Silicone Photovoltaic:* Crystalline silicone PV cells are widely used for commercial purposes. CSPV are modules built using crystalline silicone solar cells(c-Si). CSPV have high efficiency making them an interesting technology where less space is available.

Figure 4. Model of the canal top solar power generation project

D. Project Data

Table no.1. Project data of canal .

Details of Canal	
1. Length of branch canal occupied by solar structure.	500m
2. Bed of canal.	624.84m
3. Side slope.	1:5:1
4. Free board.	0.43
5. Top width of canal @ FSL.	8.3m

Table no.2. Solar panel data

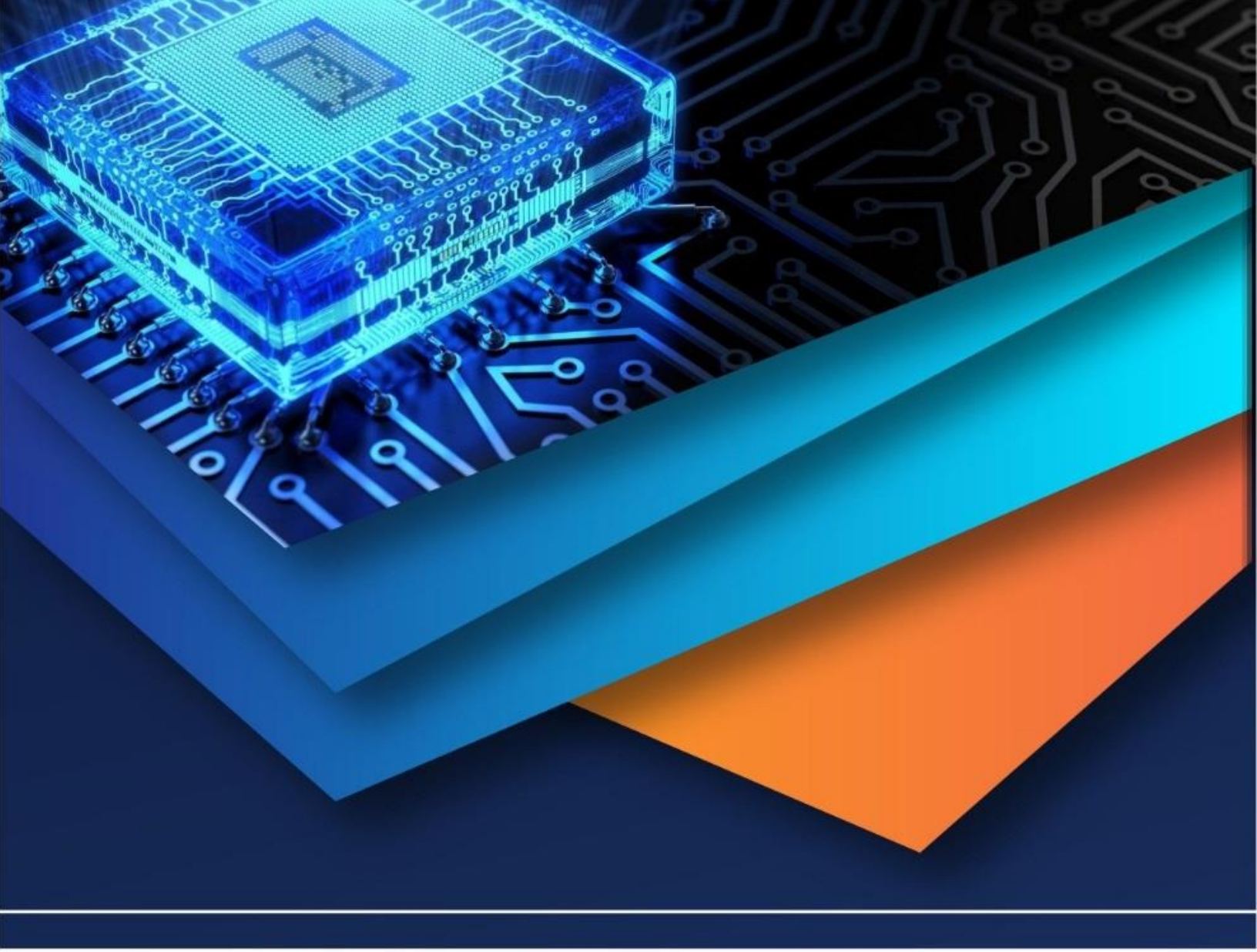
Details of Solar	
1. Panel size.	16mx4m
2. No of panel.	8.5
3. Total area of structure.	16X500 =8000Sq.m
4. Area occupied by panel.	85x5x8.3 =39440Sq.m
5. Water area under panels @ FSL.	4x85x8.3 =2822Sq.m

V. CONCLUSION

A novel concept that effectively uses land and conserves water is the canal top solar power plant. It offers a more effective administrative framework for irrigation, smart city, and smart village initiatives. Additionally, the public-private partnership (PPP) form can be used to construct it. Canal top projects are anticipated to take up an increasing share of the country's solar targets as a result of falling cost trends. The development of solar power plants in India could be accelerated and made more affordable using large capacity canal top solar parks.

REFERENCES

[1] Ming-Tse Kuo, Wen-Yi Lo, "A Combination of Concentrator Photovoltaics and Water-Cooling System to Improve Solar Energy Utilization" IEEE Transactions on Industry Applications, Vol. 50, No. 4, July/August 2014
[2] Maria Brogren, "Optical Efficiency of Low-Concentrating Solar Energy Systems with Parabolic Reflectors", Vol. 1, No. 1, January 2004.
[3] Subhash Kumar, ME Scholar, EED, Dr. Tarlochan kaur, Associate Professor, EED "Solar PV Performance- Issues and Challenges", International Journal ofVInnovative Research in Electrical, Electronics, Instrumentation and Control Engineering, Vol. 2, No. 11, pp.2168-2172 November 2014.
[4] David L. King, William E. Boyson. And Jay A., "Analysis of Factors Influencing the Anual Energy Production of Photovoltaic Systems", IEEE Transactions on Photovoltaics, Vol. 5, No. 3, July 2002.
[5] Filipa Reis, "Development of photovoltaic systems with concentration", November 2013.
[6] Omar Z. Sharaf, Mehmet F. Orhan, "Concentrated photovoltaic thermal (CPVT) solar collector systems: PartI Fundamentals, design considerations and current technologies", Journal on Renewable and Sustainable Energy Reviews, pp.1-66, July 2015.
[7] Omar Z. Sharaf, Mehmet F. Orhan, "Concentrated photovoltaic thermal (CPVT) solar collector systems: Part II Implemented systems, performance assessment, and future directions", Journal on Renewable and Sustainable Energy Reviews, March 2014.
[8] C. S. Solanki, "Solar Photovoltaics Fundamentals, Technologies and Applications", text book, Second edition, July 2013.
[9] Mehrdad Khamooshi, Hana Salati, Fuat Egelioglu, Ali Hooshyar Faghiri, Judy Tarabishi, and Saeed Babadi, "A Review of Solar Photovoltaic Concentrators", International Journal of Photoenergy, February 2014.
[10] Taylor Briglio, Jessica Galvan, Kelsey Ivan, "A Feasibility Analysis of Installing Solar Photovoltaic Panels Over California Water Canals", UCLA Institute of the Environment and Sustainability, June 2014.
[11] Antonio Colmenar-Santos, Angel Buendia Esparcia, Carlos de Palacio Rodrguez, David Borge Diez, "Water canal use for the implementation and efficiency optimization of photovoltaic facilities: Tajo-Segura transfer scenario", Journal on Solar Energy, pp.168-194, January 2016.
[12] Tina G M, Ventura C, "Numerical and Experimental Study of Enhanced Fixed Low Concentrating Photovoltaic Systems", International Conference on Applied Energy, September 2013.
[13] Parvathy Suresh, Jaimol Thomas, Anu A. G., "Performance Analysis of Standalone PV Systems Using PV Syst", Proceedings of Second IRF International Conference, June 2014.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY