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A Review: Design Parameters and Materials Needed For Fabrication of Solar Tree.

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Abstract: Electricity can be used as a power for info panels and lighting. This paper presents results from possibility study of implement action of Solar Tree. The paper is focused on the design, technology and economy part of above mentioned study. Except results of technology and Solar Tree is a metal structure that looks like a real tree with branches at the top of which are solar panels. These solar panel collect solar energy and transfer it to electricity which can be used for batteries charging of mobile phones, tablets and portable computers. Also, collected economy parameters, three different design solutions of „Solar Trees "adjusted for urban environment will be presented. Using 3D CAD modeling software different approaches where designed by means of getting photorealistic pictures (rendering) of those solutions in chosen urban locations.
Keywords: Angle of incidence, Design, Renewable Energy, solar tree, solar panel, sun-earth angles, series connection, parallel connection, zenith angle.

I. INTRODUCTION

In industrialized countries the energy consumption has been increasing at a very fast rate. Because of increasing energy and growing population one option to fulfill the increasing demand of energy is renewable energy source. Keeping this option in mind we should also take care that energy should not cause pollution and other natural hazards. Therefore nonconventional energy sources such as ocean tides, geothermal, sun and wind are good option. With this alternative energy sources we can fulfill the energy demand in coming future. In all these alternatives solar energy has more advantages for the mankind i.e. Solar Energy is free, inexhaustible and nonpolluting. Solar energy is most advantageous for countries having very less space to produce energy efficiently and having very large population like India. In all these solar tree could be the best option. This technique can also be used for system of street lighting, industrial power supply etc. In area point of view, solar tree is more efficient and much better than the traditional solar PV system. Therefore it should be implemented. Solar energy is available in very large amount and also easily available. The solar radiation can be directly converted into solar photovoltaic, solar thermal and solar architecture. The installation of large solar collector requires a very big space. which is the main problem associated with tapping solar energy .This problem can be avoided by installing a Solar Tree requiring less space instead of a no of solar panels. To satisfy pressing environmental and social demands for urban lighting solar tree opens new prospects.

With depleting conventional sources of energy, the world is looking towards renewable energy sources viz solar, wind, tidal etc. Sun, a star, radiates lot of solar energy onto earth surface and is a perennial source of energy. The amount of solar energy incident on the earth's surface is approximately1.5 x 1018 kWh/year. The density of power radiated from the sun (referred to as solar energy constant) is 1.373 kW/m2.

Many individual solar panels are installed on poles and they produce electricity by absorbing solar energy. However, the space around the pole and below the solar panel is a huge potential to increase the solar power by many folds, suitably named, "SOLAR TREE". The present paper aims at building an array of solar panels by installing the panels on a welded stem to a pole. The tilt angle of solar panel and other parameters suitably depend on the coordinates of the local area of installation.

II. LITERATURE REVIEW

A. Ali Rachini et al monitored grid connected photovoltaic system to evaluate the performance and the efficiency of conversion of solar energy into electricity. The monitoring system detects abnormal operations and power fluctuation in the grid connected PV system. It gives the possibility to optimize control laws and to implement interconnection strategies. It is used to evaluate the cost effectiveness of solar energy [1]Conclusion: A photovoltaic system connected to the grid is continuously monitored in order to evaluate the performance and the efficiency of conversion. The monitoring system detects abnormal operation and power fluctuation in order to execute appropriate tasks. It gives the possibility to optimize control laws and to implement interconnection strategies. Moreover, it is used to evaluate the cost effectiveness of solar energy penetration. It is continuously

updated in order to improve accuracy of result and to take real time decision. Measurements are performed in the Center of Renewable Energy and saving.

B. Abhishek Agrawal.et.al, studied the theoretical aspects of choosing a tilt angle for the solar flat-plate collectors used at different locations in India. Based upon the measured values of monthly mean daily global and diffuse solar radiation on a horizontal surface, the calculations are done. It is shown that if the angle of tilt is varied seasonally, four times a year then nearly optimal energy can be collected. Annual optimum tilt angle is found to be approximately equal to latitude of the location [2]Conclusion: The optimum angle show some variations when compared with values reported in the literature. The amount of solar radiation incident on a tilted module surface is the component of the incident solar radiation which is perpendicular to the module surface. The array's tilt is the angle in degrees from horizontal. A flat roof has 0 degree tilt and a vertical wall mount has a 90 degrees tilt angle. Whether you are installing solar panel on a flat roof or a pitched roof, the output of the solar PV system would be increased by optimizing the tilt angle. This paper gives the information about the theoretical aspects of choosing a tilt angle for the solar flat-plate collectors used at different locations in India. So the calculations are based upon the measured values of monthly mean daily global and diffuse solar radiation on a horizontal surface. It is shown that nearly optimal energy can be collected if the angle of tilt is varied seasonally, four times a year. Annual optimum tilt angle is found to be approximately equal to latitude of the location. This study determined that PV module oriented towards the South gives the greatest value of electrical energy for the angle of 30.

C. Boyo A O et al compared solar radiation data measured with the satellite and the ground measurement radiation was analysed. The ground measurement radiation consists of data at the ground level and in the atmosphere. The Kolmogorov-Smirnov test assesses statistical similarity between the two sets of data which was applied to global horizontal daily radiation data value from Gun-Bellani Pyranometer collected at Nigeria Meteorological Agency Oshodi, Lagos and Satellite data from National Aeronautics and Space Administration (NASA). The differences in data are because of the behavior of measured data at a particular station, such as recording errors and behavior of estimates made from satellite images [3]

D. *Conclusion:* - Life largely depends on the radiation from the sun. This is mainly because virtually all physical, chemical and biological processes occurring near the ground or in the atmosphere involves energy transformation. The solar radiation data at ground level and in the atmosphere are an important feature in solar energy applications such as photovoltaic systems for electricity generation, solar collectors for heating and passive solar devices. In this paper a comparison of solar radiation data measured with the satellite and the ground measurement radiation was analyse. The Kolmogorov-Smirnov test which is use in assessing statistical similarity between the two sets of data was applied to global horizontal daily radiation data value from Gun-Bellani Pyranometer collected at Nigeria Meteorological Agency Oshodi, Lagos and Satellite data from National Aeronautics and Space Administration (NASA). The result affirm that the new parameters contribute valuable information to the comparison of the data sets complimenting those that are found with Mean Bias and Root Mean Square difference.

E. Farshid Mostofi.et.al, studied an optimization model of hybrid energy system for a hybrid system implemented in the north part of Iran is presented. The optimization solution is provided by HOMER software compared with a solution given by a genetic algorithm implemented in MATLAB software. The paper presents an interesting source for the implementation of hybrid systems in isolate areas. The main purpose of combination PV, wind, fuel cell and hydro units is to reach a reliable applying with minimum initial and operation cost. The results show that the optimized configuration produces high efficiency for LPSP of 1.23%. Implementation of this energy system will supply the area's demand as well as it has no emissions and reduces the environment pollutions [4]. The main investigations and studies on combination of (hydro, PV, Wind and fuel cell) system with a small hydropower plant is to provide the demanded power from waterworks facilities and also reducing the cost of installation and utilization .all summarized information have been gathered from 20 years duration to achieve a precisely survey of the expenditures. Also this study has been assisted by information from one of outlying places of Ardabil province bested on northwest of Iran. To optimize the referred combination, Artificial Bee Colony (ABC) has been utilized and attained results accomplished by PSO algorithm and HOMER software. According to reliability indexes of referred system, it is obvious that, comparison reliability improvement percentage between (hydro, PV, Wind and fuel cell) system and referred system without hydropower plant in ELF index is 43.49%, LOEE is 37.56% and LOLE is 59.47%. In spite of notable reliability of referred syste.

F. Immanuel Alphonse.et.al**,** detailed the designing of a solar powered BLDC Motor Driven electric vehicle. Immanuel selected the appropriate components for the application and the various components for the same is subjected to various tests, cross checked with simulation results. The designing of the whole system depends on the application for which it shall be used, and accordingly the components are chosen. It was observed that according to the application, the motor was chosen first. From the

rating of the motor, the battery which could satisfy its starting current and full load current was been selected, and then according to the rating of the battery, the solar charge controllers and the solar modules were selected. Finally the BLDC motor mounted upon the frame realized the prototype of the vehicle which was tested at different load condition [5]

G. *Conclusion:* The importance of making shift in the source of energy which is made cost effective was put forth, and utilization of solar power in vehicle application was implemented. The objective of selecting the appropriate components for the application was studied, and the various components for the same is subjected to various tests which was cross checked with simulation results too. The designing of the whole system depends on the application for which it shall be used, and accordingly the components are been chosen starting from the motor to the solar modules. It was observed that according to the application, the motor was chosen first. From the rating of the motor, the battery which could satisfy its starting current and full load current was been selected, and then according to the rating of the battery, the solar charge controllers and the solar modules were selected .Finally the BLDC motor mounted upon the frame realized the prototype of the vehicle which was tested at different load condition

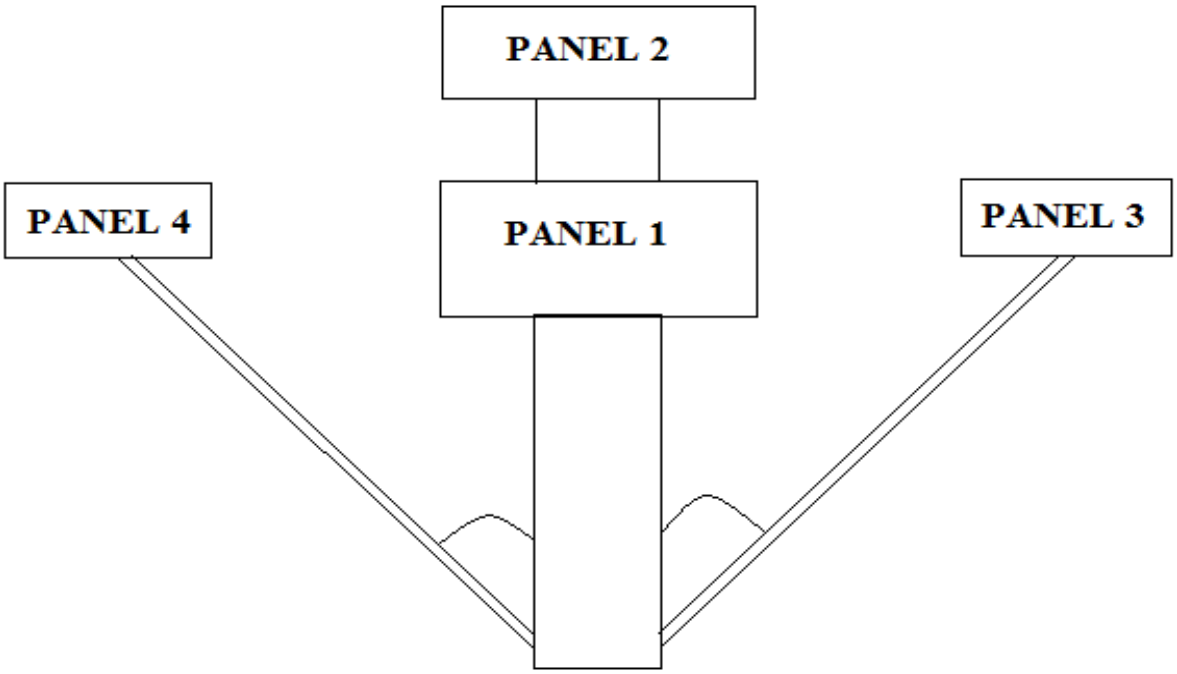
H. J C Mourmouris.et.al**,** did a case study for the island of Samothrace, Greece and analyzed that Samothrace has a high potential for energy resource exploitation (mainly Wind and Solar), but has social acceptance problems because of its social, economic and environmental situations[

I. *Conclusion:* In the present study, a techno-economic feasibility of stand-alone, renewable energy systems to meet the electricity requirements of a typical small island of Greece was investigated. HOMER was used for the analysis, and viability was determined based on NPC and COE. From this study, it is clear that the optimized Wind-PV-Battery hybrid system is more cost effective compared to Wind-Battery or PV-Battery systems for the load with 10% annual capacity of shortage. However, such problems are multidimensional in nature, requiring an integrated approach to problem solving which takes into account, economic, social, environmental, and other aspects. In such a framework, multi-criteria evaluation has proved to be a useful tool, as such studies need to take into consideration both quantitative and qualitative aspects. The established framework, which is based on the REGIME method, highlights the main procedural characteristics of decision-making and adopts an analytical approach with respect to the optimal exploitation of RESs. It was shown that, due to the multi-faceted nature of RESs and the specific difficulties associated with the coexistence of diverse activities in certain areas, their exploitation is best promoted through a step-by-step approach. Results obtained by the multi-criteria evaluation show that the wind-PV-battery system is the most efficient RESs in the region under consideration, followed by wind-battery and PV-battery systems, according to the evaluation criteria which use

J. Eke.et.al, studied the operating parameters of KA58 amorphous silicon PV module and investigated the parameters as a function of solar irradiation and atmospheric conditions using current-voltage curves. This was done from April to May at Mugla Sitki Kocman university PV outdoor test site. Current-voltage curves of thin film solar cells and modules are explained by single diode model, In a period of 12 months, the PV module exhibits different response to changes in solar irradiation and weather conditions[7]Operating parameters of a KA58 Amorphous Silicon (a-Si) photovoltaic module is investigated as a function of solar irradiation and atmospheric conditions using current-voltage curves taken for a year from April to May at Mugla Sıtkı Kocman University PV Outdoor Test Site. Single diode model is proposed to explain the current-voltage curves of thin film solar cells and modules. It is observed that the operating parameters of a KA58 a-Si photovoltaic module exhibit significantly different response to the changes in solar radiation and weather conditions in a period of 12 months. Correlations between internal parameters, namely RS, RP, IL, IO and a (modified ideality factor) of module and solar irradiation and atmospheric data is investigated.

III. METHODOLOGY

To save roof top space of buildings is the need of solar tree. The solar tree consists of solar panels arranged in a spiral fashion around a pole such that shadow of one panel does not fall on other. Once developed, the solar tree can be installed in public places and along sides of roads. The solar tree can be installed at one corner on the roof top of a building and rest of the space can be used for any other purposes. Solar tree can also be installed on the ground. However, care should be taken that no shadow falls on the panels. The figure shows the circuit diagram of a typical solar tree with series and parallel connections. The panel 1 is connected in parallel to panel 2 while panel 3 is connected to panel 4 in a parallel connection. Both the parallel connections are connected in series. The whole circuit of panels (LB1 13003680) stores energy in a battery rated at 12 volts. The specifications of the panels are as given in table 1. The panels face southwest at an inclination of 350(Latitude is28035’). The solar tree is designed for new delhi region.



IV GENERAL DESIGN CONSIDERATION

Possible design solutions do vary according to many different factors. There are several of them. Authors tried to adjust their potential design solution with regards to some of them, which they believed to be the most influencing. Furthermore, with the beneath listed criterias authors tried to establish a general design solution algorithm based on the available project and design documentations for some solar trees.

A. *Location regarding light conditions.* One of the most important factors is the potential location where the tree should be placed. Urban environment is very specific regarding the surrounding objects which substantially influence light conditions around the tree. The potential location should be chosen carefully to enable optimum light conditions during the day.

B. *Location regarding the final purpose.* The majority of solar trees in urban environment is dedicated for two potential assignments: Street lighting or powering different consumers e.g. battery chargers for different types of mobile device, LCD monitors etc. According to the chosen aim of the tree, the final design is influenced especially in the ground attaching area.

C. *Available type and design of solar panels.* According to the fact that the panels are the most important part in a solar tree construction it is therefore a crucial part which influences the final look of the design. Mass, shape, number and the arrangement of the panels finally influence the rigidity, center of gravity and other calculation outputs of the tree which lead to the final look of the design.

D. *Aesthetic requirements.* If the design of the tree and its look should be preferred in regard to the purpose then this will eventually lead to more complexity throughout the whole design process. This parameter is closely related with the previously mentioned. This criteria is very difficult to generalize but requires detailed investigation of individual tree projects.

E. *Financial costs.* Even though it is mentioned as the last one, it is probably the most influencing criteria in every project. The complexity combined with the variety of previously mentioned parameters sets this criteria as a final justifier for every possible solar tree design solution.

V. CONCLUSION

The present study increases the solar power output by the number of solar panels installed on a pole in comparison to a single panel pole system. The structure of solar panel system is given a tree shape. The panels are put on the structure in a spiral fashion. It proves to be a useful system to meet the energy demands of the world and to use a given space more efficiently. The present system

of roof top solar systems can be replaced by solar tree and the roof top space can be utilized for recreation purposes. The solar tree can be installed on ground also in addition to roof top spaces. So, this solar tree proves to be advantageous in saving space and increasing the power output by many folds. It saves a lot of energy over the years to come. The number of solar trees that could be installed in a given space depends on the wattage needed.

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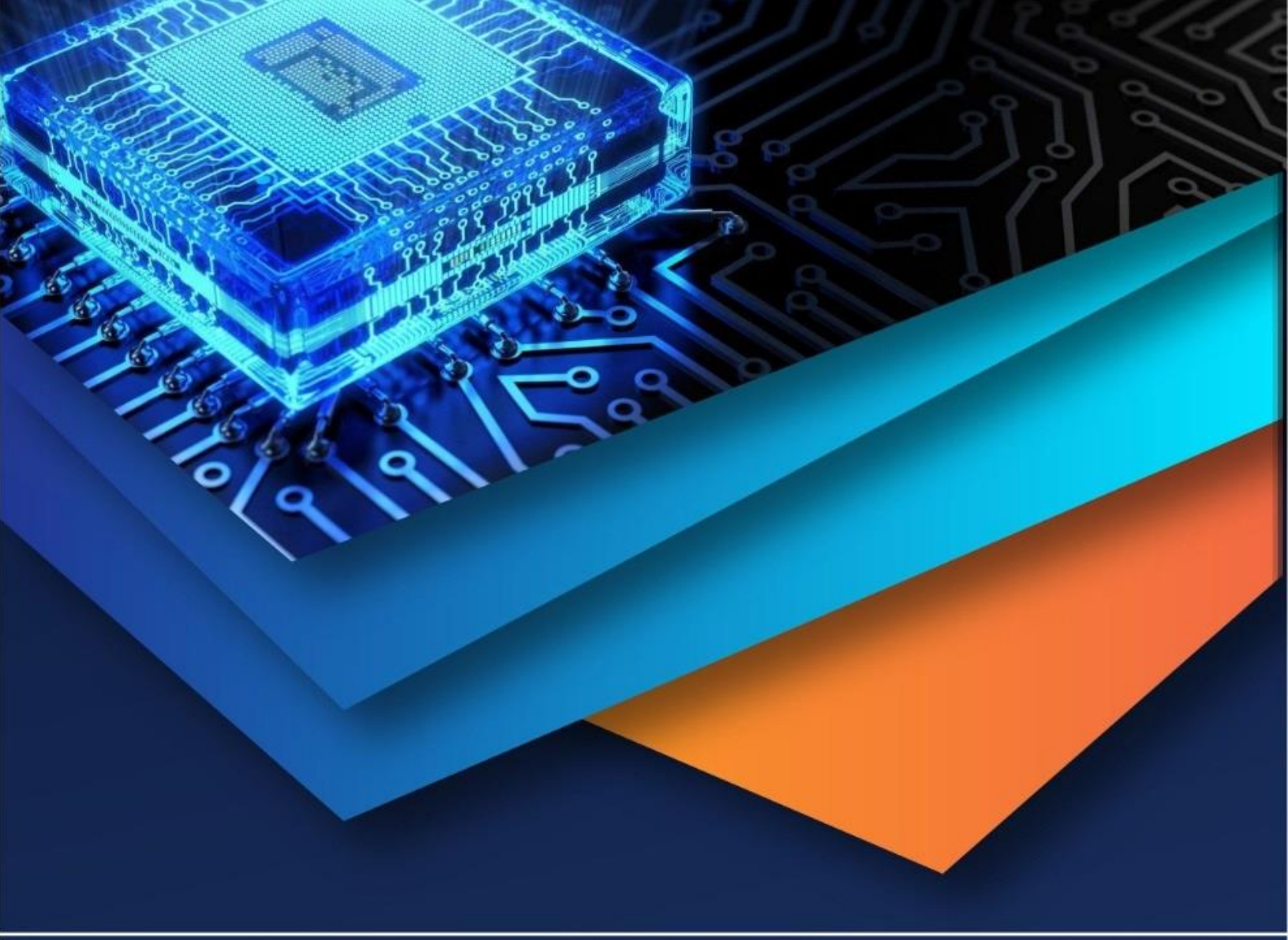

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