NEW APPROACH OF USING A-300 SOLAR CELL IN SOLAR TREE FOR ENERGY CONVERSION IN THE RAJASTHAN REGION

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Abstract: Energy is required to perform any of the operation in the world ranges from involving the small to large momentum. As the sources of energy are limited so depending upon the solar energy is the future. Rajasthan is growing in both the industrial as well as residential prospects day by day, with the arrival of new industrial project also with the growth in the development of more residential township in Rajasthan by government as well as in private sector. This also put an increase in the requirement of the electricity. Thus, an alternative source of electricity is always in the higher demand. Thus, the solar tree proposed in our dissertation will help lot in this regard. In our paper we have research the efficiency of the A-300 cells usage in the solar tree, saving both the energy and save required for the installation. In this paper we have mentioned better efficiency performance of the solar tree is obtained using the A-300 cells.
Keywords: Solar Cells, Solar Energy, A-300 Cells.

I. INTRODUCTION SOLAR TREE

Now days with the growing population and energy demand we should take a renewable option of energy source and also we should keep in mind that energy should not cause pollution and other natural hazards. In this case the solar energy is the best option for us.

India is a highly populated country, so we should take the advantage of such an energy which requires a very less space to produce energy efficiently. In this case solar tree could be the best one for us . We can also use the technique called "SPIRALLING PHYLLATAXY" to improve the efficiency of the plant.

Solar trees are intended to bring visibility to solar technology and to enhance the landscape and architecture they complement, usually in a commercial or public context. An objective of many solar tree installations is to promote awareness, understanding, and adoption of renewable energy. They are not typically used as a primary source of energy for a property—that role is accomplished by rooftop solar systems. Solar trees are complementary to rooftop solar systems, or other green building measures, symbolizing these larger investments and their environmental benefit. A solar tree is a decorative means of producing solar energy and also electricity. It uses multiple no of solar panels which forms the shape of a tree. The panels are arranged in a tree fashion in a tall tower/pole.

TREE stands for
T= TREE GENERATING
R=RENEWABLE
E=ENERGY and
E=ELECTRICITY

This is like a tree in structure and the panels are like leaves of the tree which produces energy.

Components of Solar Tree

The solar tree consists of mainly five parts to design.

- Solar panels
- Long tower
- LDEs
- Batteries

Solar Tree Features

Tree can produce their own food material by the process called PHOTOSYNTHESIS. Leaves are producing food materials for human beings. Likewise in solar tree solar plates are producing energy for the society.

Need of Solar Tree

Due to less land requirement

It require less land as compare to traditional PV system. So we require such a plant which can generate max. energy using minimum land.

Efficient energy generation

It can generate energy very efficiently as compare to traditional system. It can collect energy from wind. The stem are flexible so that they can rotate in any direction and by shaking themselves they produce energy also from wind as in the case of a natural tree.

Figure 1 Solar Tree

Solar Tree in India

India being a developing country and highly populated

requires a power plant where maximum energy can be generated by using minimum land.
We must try to produce energy from sun by using solar tree in our country to increase our per capita land and fulfill the growing energy demand.

Advantages
- No air pollution
- We wouldn't have to worry as much about future energy sources
- People in poor country would have access to electricity
- People can save money
- Land requirement is very less

Disadvantages
- Cost is high
- May cause hazards to the birds and insects
- Hazards to eyesight from solar reflectors

II. RELATED WORK

A. de Villiers and H. J. Vermeulen [2] The South African Renewable Energy Independent Procurement Program has offered ascend to the authorizing of various utility size solar photovoltaic plants lately. Constrained research has been led locally into execution checking and benchmarking of these extensive scale solar photovoltaic plants. This paper displays the consequences of an exploratory examination to research the capability of Data Envelopment Analysis for assessing the energy change execution of an utility size photovoltaic plant. The outcomes acquired with Date Envelopment Analysis are translated with regards to comes about got with customary techniques and with reference to the impacts of nearby climate conditions on plant execution. Plant execution is analyzed both after some time and as far as its individual parts. DEA is found to have potential as an execution and condition checking instrument.
R. Oprea, M. Istrate and D. Machidon [3] These days, like never before, the inexhaustible wellsprings of energy are profoundly misused to maintain the power utilization around the world. The expanding nearness of these sustainable source's based power plants had really changed the structure of the power system itself, prompting new difficulties as far as power system's operation. The photovoltaic transformation of the solar energy is of awesome intrigue and this division saw a critical development in the most recent decade. Therefore, a 4.32 kW photovoltaic power plant was produced at the Electrical Engineering Faculty of Iasi, Romania, for both research and pedantic exercises and furthermore to supply a few burdens. Alongside this paper the photovoltaic power plant's effectiveness is broke down, deciding the energy yield all through a few time interims.
S. S. Rangarajan, E. R. Collins, J. C. Fox and D. P. Kothari [4] Photovoltaic energy (PV) is one of the cleanest types of sustainable power source. The fame of this innovation has been broadly perceived with the motivations gave by the legislatures of different countries over the globe. Step by step, the development rate of PV is consistently expanding. Sustainable power source assets like PV are interfaced with control electronic inverters to empower its interconnection to the power system arrange. The regular power system turns out to be more mind boggling with expanding sustainable power source interconnections to constitute a more quick witted lattice. As the decentralized era accomplished by PV solar plants turns out to be more predominant, the network dependability turns into a critical aspect. The repercussions related with the PV interconnection needs an adherence to solid operation of the lattice with no infringement. Interconnection measures are obviously basic. A few associations and specialized advisory groups are always engaged with research to refresh and modify such guidelines on a successive premise all through the world. The concentration of this paper is to display a united arrangement of PV interconnection measures over the globe.
N. A. Khan, G. A. S. Sidhu and F. Gao [5] The dispatch of energy at least operational cost of warm energy sources has been a huge piece of research since decades. As of late, with expanding interests in sustainable power source assets, the ideal monetary dispatch has turned into a testing issue. This paper presents consolidated outflow financial dispatch demonstrate for a solar photograph voltaic coordinated power system with various solar and warm creating plants. We figure blended whole number double programming issue subject to different down to earth limitations. A deterioration system is proposed where the first issue is part into two sub-issues. Molecule swarm improvement, Newton-Raphson strategy, and paired whole number programming systems are misused to locate the joint streamlining arrangement. The proposed show is tried on the IEEE 30 transport system. The reproduction comes about exhibit the viability of the proposed display.
M. Kayri, I. Kayri and M. T. Gencoglu [6] In this examination, the estimation exhibitions of Multiple Linear Regression, Random Forest, and Artificial Neural Network are inspected relatively. For examination of these information mining systems, the power generation information from a Photovoltaic Module was utilized as a part of the research. In this examination, the model was constituted from seven factors. One of the factors is needy (control) and the others are free factors (worldwide radiation, temperature, wind speed, wind heading, relative dampness, solar rise edge). In this paper, the Mean Absolute Error and the connection coefficient were utilized as a part of request to analyze the estimation execution of the said information mining procedures. While the relationship coefficient is 0.963 in Multiple Linear Regression show, the connection coefficient is 0.986 in Random Forest choice tree strategy. The most elevated connection coefficient was gotten in Artificial Neural Network design (R = 0.997). As indicated by the three information mining strategies, the worldwide radiation was found as the most imperative indicator. While the minimum critical indicator is the breeze bearing in both the Artificial Neural Network and the Random Forest models, the solar rise point is the slightest imperative indicator in the Multiple Linear Regression demonstrate.
A. Boulmier, J. White and N. Abdennadher[7] These days, the energy generation from solar radiation turns out to be more vital in the light of current ecological difficulties. Ebb

and flow research goes for joining solar energy era with urban arranging so as to expand productivity. The objective is to assess the capability of building rooftops situated in urban territories for delivering solar energy. This paper manages a choice emotionally supportive network that figures the solar energy capability of surfaces in urban scenes. The system ought to distinguish "great competitor" rooftops for introducing solar boards. It ought to measure the solar power a rooftop could create by considering neighborhood climate, rooftop's introduction and how much shade falls on it from adjacent trees and structures. The system depends on a CPU and memory serious "shadow process" calculation. We propose two ideal models to portray this calculation. The first depends on an ordinary parallelization. The second worldview depends on an advanced information dispersion. The two standards have been actualized on distributed computing frameworks. The paper analyzes the two techniques on the premise of two criteria: execution and sending cost.

III. PROBLEM STATEMENT

India is a profoundly populated nation, so we should take the upside of such an energy which requires a less space to create energy proficiently. For this situation solar tree could be the best one for us. It is greatly improved than the customary solar PV framework in region perspective and furthermore more productive. So this will be a decent choice and ought to be executed.

For the conventional framework we require substantial size of land to create a little measure of energy. It requires around 1% arrive as contrast with the conventional framework. Solar energy is accessible in plenitude and considered as the least demanding and cleanest methods for tapping the sustainable power source. For coordinate change of solar radiation into usable frame, the courses are: solar warm, solar photovoltaic and solar design. Be that as it may, the principle issue related with tapping solar energy is the necessity to introduce substantial solar gatherers requires a major space. To maintain a strategic distance from this issue, we can introduce a solar tree despite a no of solar boards which require a little space.

Illustration – To create 2 MW control from a pv module we require 10 - 12 sections of land of land for lodging of boards however for a similar measure of energy we require just 0.10-0.12 sections of land of land if there should be an occurrence of solar tree.

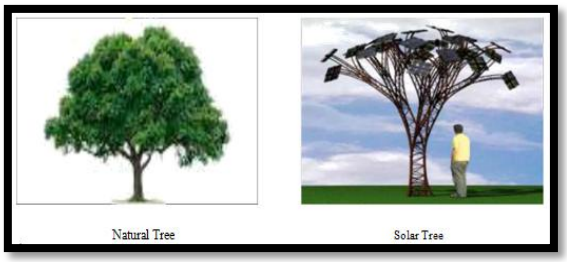

Figure 2 Natural Trees and Solar Tree

Sustainable power source is a socially and politically characterized class of energy sources. Sustainable power source is for the most part characterized as energy that originates from assets which are constantly recharged on a human timescale, for example, daylight, wind, rain, tides, waves and geothermal warmth. While numerous sustainable power source ventures are expansive scale, inexhaustible advances are additionally suited where energy is frequently vital in human improvement.

3.2 Need of Solar Tree

- Less Land Requirement: In correlation conventional PV framework, Solar Tree requires less land. In this way, a plant is creating greatest. Energy by utilizing least land.
- Efficient Energy Generation: Solar Tree can produce energy proficiently.
- Collection of Energy from Wind: Solar Tree with adaptable stem turning toward any path and by shaking themselves can create energy likewise from wind like a characteristic tree.

IV. PROPOSED WORK

Sun Power A-300 Cells

SunPower is preparing its first factory to create A-300 solar cells. The A-300 is a back contact solar cell with effectiveness more prominent than 20% and a matrix free front surface. Its structure, temperances, prevalence and creation have been introduced somewhere else.

Light catching makes the "optical thickness" of a solar cell more prominent than its genuine thickness. This is accomplished by

(1) coercing light beams to go sideways through the cell; and

(2) establishing a non-zero inner reflectance at the front and back surfaces to keep beams from getting away.

By making the optical thickness more prominent than the genuine thickness, one powers the light beams to invest more energy in the solar cell, which prompts a more noteworthy assimilation of long-wavelength photons, and henceforth, a bigger age current JG.

Figure 3 shows how JG relies upon the optical thickness of SunPower's A-300 solar cell for two cases:

(I) unencapsulated, and (ii) exemplified.

JG was found by deciding the light transmitted into the cell with an in-house optical model that uses the lattice strategy sketched out by Macleod [2], and by accepting the retention coefficients for band-to-band ingestion and free-bearer assimilation as given by Reference [3] for silicon. The optical model accept ordinarily occurrence light, 100 mW/cm2, AM1.5g range [4], idealize pyramidic surface (54.75°) on the front surface, a TM:TE polarization division of 1:1, non-dispersive media, specula reflection, 300 Å of a SiO2 passivation layer, and 450 Å of SiN. The transmission of the embodiment was measured by SunPower for one layer of glass in addition to 0.2 mm of EVA; the estimations of n(l) and k(l) for SiO2 were taken from Palik [5] and those of SiN were measured by spectroscopic ellipsometry from a PECVD SiN film saved by Roth and Rau.

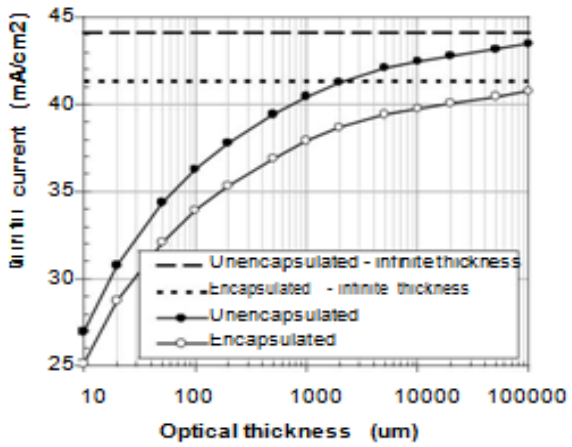

Figure 3 Generation current vs optical thickness for SunPower's A-300 solar cell under one-sun illumination; other assumptions are listed in the text.

Figure 3 shows the extensive change in JG that can be picked up by expanding the optical thickness. For example, if the cell were 250 µ m thick with no light catching, an unencapsulated cell would swear off very nearly 6 mA/cm2 (13%) of the accessible age current. In the event that a similar cell consolidated light catching with the end goal that the optical thickness was 1500 µ m (i.e., Z = 6), the misfortune in age current would be split to 3 mA/cm2.

Light catching is regularly evaluated by the pathlength improvement factor Z, where Z is characterized to be the optical thickness WO partitioned by the cell thickness W:

Z = WO/W .

The reason for this work is to decide Z for SunPower's A-300 solar cell, and to investigate financially practical approaches to expand Z.

Light Trapping In the A-300

Figure 4.2 delineates the applicable highlights of the solar cells examined in this investigation. The front surface is finished with arbitrary pyramids (54.75°) and covered with a passivating SiO2 film and a hostile to intelligent film; the surface refracts the episode light so it ventures out sideways to the plane of the cell, along these lines expanding the optical pathlength..

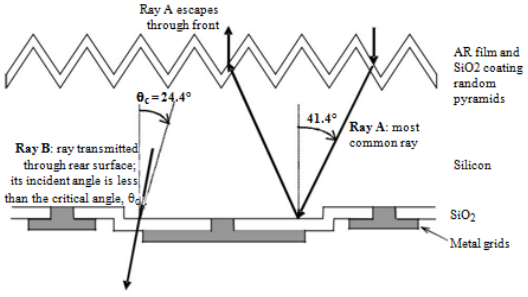

Figure 4.Schematic diagram of A-300 solar cell

The back surface is planar and covered with SiO2 aside from where the metal reaches to silicon. The metal constitutes the positive and negative terminals, and it frames an example of interdigitated fingers over the majority of the cell.

As an outcome of the metal example, there are three interfaces at the back surface: (I) Si– metal at the contacts,(ii) Si– SiO2– metal in the areas far from the contacts yet under the metal network, and (iii) Si– SiO2 in the districts between fingers. The extent of the back constituted by every interface is (I) 2.5%, (ii) 79% and (iii) 18.5%, for the cells of this investigation.

In a perfect world, we might want to determine an express condition to depict the optical thickness of the structure. In any case, this approach is puzzled by the pyramids at the front surface, which, and also transmitting some part of a beam into the cell, mirrors the rest of the beam onto different pyramids. Subsequently, the front surface prompts the duplication of beams, making the deduction of an unequivocal articulation inconceivable. (The duplication of beams happens for both outer and inner beams.)

We in this manner fall back on experimentation and PC beam following to find out the optical thickness of our cell. Before showing the outcomes, we depict a few properties of the structure.

TABLE 1 SUNPOWER'S HIGH EFFICIENCY

	Thin Film	Conventional	Sun Power
Peak Watts / Panel	65	215	300
Efficiency	9.0%	12.8%	18.4%
Peak Watts / m2	90	128	184

ADVANTAGE - UP TO TWICE THE POWER

Measured at Standard Test Conditions (STC): Irradiance 1000W/m², AM 1.5, and cell temperature 25° C

TABLE 2 ELECTRICAL DATA

Nominal Power (+5/-3%)	P_{nom}	300 W	
Rated Voltage	V_{mpp}	54.7	V
Rated Current	I_{mpp}	5.49	A
Open Current	V_{oc}	64.0	V
Short Circuit Current	I_{sc}	5.87	A
Maximum System Voltage	IEC	1000 V	
Temperature Coefficients			
	Power	-0.38% / K	
	Voltage (V_{oc})	-176.6mV / K	
	Current (I_{sc})	3.5mA / K	
NOCT		45° C +/-2° C	
Series Fuse Rating		15 A	

Limiting Reverse Current (3-strings)	^{1}R	14.7	A

V. CONCLUSION

Exceptional development in the interest for energy alongside the mindfulness about condition and wellbeing dangers of petroleum products have made researchers broadly explores the option spotless and sustainable power sources. Among different conceivable inexhaustible sources 'solar energy' can possibly satisfy the energy requests of future ages in a domain agreeable and manageable way. Critically the solar energy can likewise control production of other clean types of energy, for example, hydrogen which is anticipated to be 'the fuel of future' in light of zero ozone depleting substance outflows and high energy effectiveness upon ignition. Current best in class silicon-based photovoltaic (PV) innovation is moderately costly and hence growing conceivably less expensive PV advancements utilizing arrangement process capable earth inexhaustible material frameworks is the need of the present time. With the appearance of nanotechnology it has turned out to be progressively conceivable to comprehend, control and control the material properties in a remarkable way because of which a few new ideas and outlines of solar cells, hydrogen age and optoelectronic gadgets have developed.

Throughout the exploration work introduced here a few intriguing and exceptional advancements in the field of energy have happened on the global front. Because of significant deluge of solar cell/boards from China and Japan the silicon photovoltaics division has seen a value drop of just about 67% when contrasted with the year 2010, which has unquestionably stressed the momentum innovative work in this field. In this way future advancements in the field of energy (photovoltaics or PEC water part) ought to be founded on the earth inexhaustible and economical materials with low preparing cost so as to have the capacity to make due in the ferocious rivalry with the silicon innovation. Late extraordinary advances in the field of natural inorganic half and half perovskite materials for energy applications have surely helped the would like to create energy arrangements requiring little to no effort when contrasted with silicon innovation.

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