Designing and Fabrication of Solar Tree
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Abstract:
Energy is important to the economic process and social development of any country. Indigenous energy resources important to be developed to the optimum level so attenuate dependence on foreign fuels, subject to partitioning economic, environmental and social constraints. This is important to a lift in analysis and development likewise as investment in renewable energy business in search of how to satisfy energy demand and to cut back dependency on fossil fuels. Wind and solar power are getting standard due to abundance, handiness and simple harnessing for electric power generation. Reaching the non electrified rural population is presently unfeasible through the extension of the grid, since the affiliation is neither economically possible. Further, there will be increase in oil costs, and also the intolerable impacts of this energy supply on the users and on the surroundings, square measure slowly removing standard energy solutions, like fuel gents based mostly systems, from the agricultural development agendas, “Hybrid Power Generation” ie. Solar and wind based energy generation. This paper presents the design of hybrid electricity generation system by utilizing both solar and wind renewable energy to the domestic household in the remote area which is unable to connect to the grid. Hybrid systems have tested to be the most effective choice to deliver, “high quality” power.

Keywords: Solar Panel, Solar Tree, Wind Turbine.

I. INTRODUCTION
Solar Energy is accepted as a key resource for the future of the world. The utilization of solar energy could cover a significant part of the energy demand in the countries. One of the most popular example of utilized solar energy that is solar tree. In this paper illustrates the various review about the solar tree and development of Solar Tree for domestic application considering the average requirement of small Indian house. Therefore, in this paper, an attempt has been taken to summarize the past and current research in the field of solar tree technology. The main objective of this paper is to present the review about the solar tree. In the world the utilization of energy is increasing day by day and therefore we required the renewable energy sources which are pollution free and easily available like sun light. Sun light is utilized by solar panels but when we required an array of panels the land requirement also increases which arises as a problem. For solution of this problem and for getting more energy we use solar trees. In these trees basically there are solar panels which are arranged in Fibonacci series for getting more energy and the requirement of the land is less. Because of less requirement these are easily installed and these can be used in straight lighting, home supplies and in industries etc. The sun light easily available so these are very beneficial there is no worry of availability of sun light in future because till the end of the world this is also available. Meaning of the TREE in Solar Trees

T= Tree generating
R= Renewable
E= Energy and
E= Electricity

Rein Trifled is a solar environment a list artist that has also begun to construct solar trees. He is one of the founders and the current president of the Solar Tree Foundation which began in 2008. The Solar Tree Foundation designs programs for elementary school students to show them the creative process for constructing a Solar Tree in order to educate a broad audience on the environmental and technological material. It’s also designed with the intention of instilling an appreciation for artistic aesthetics interpreted through sculptures as a medium of expression. This is performed by online lectures and webcams in which the students can engage with the architects and see the construction process in real time. Trifled believes that his Solar Trees will help preserve natural trees in the long run. The latest solar tree constructed by the Solar Tree Foundation was erected for North Hillsborough Elementary School in Hillsborough California. At peak efficiency, the 10,000 lb. Solar Tree is claimed to produce 20,000 watts of energy per day. Wind Energy demand is a key factor in the economy of a country. The energy demand in India increased rapidly to an average of 6.4% during 1990–2010, thanks to the significant economic growth in this period. As a consequence of this drastic increase in energy demand, the conventional sources of energy are depleting very fast. An ill-effect of usage of conventional energy sources to meet the demand, is the loss to environment and public health. The result of pollution like global warming, skin cancer, etc., has forced the scientific community all over the world to focus on alternative source of energy which can be renewed and should cause considerably less damage to the environment. Use of renewable energy sources results in less emission of greenhouse gases and other harmful gases such as SO₂ different oxides of nitrogen and by-products of fossil fuel which are responsible for the environmental degradation, health problem etc. The continuous attention and increased use of renewable energy may restrict the dependency of country on imported fossil fuel and will lead India toward self-sufficiency and energy independence. Hence, it is necessary to expand and utilize the renewable energy sources like wind, solar, biomass, hydro power, waste to energy etc. Wind is air in motion. The uneven temperature distribution due to solar radiation and earth's rotation are the two main causes of wind. Wind energy is a renewable, inexhaustible and non polluting
source of energy. It is an environment friendly, developing and popular alternative source of clean energy. As a source of power, the potential of wind energy is huge. This is clear from the rapid increase in cumulative global capacity, reaching 539 GW at the end of 2017 representing 10.7% of cumulative market growth.

**Technology Description:**
Solar tree has unique properties in terms of height and multi-angle orientation parameters. By employing the height parameter, solar tree requires less space consumption which can reduce the installation cost. Compared to the traditional solar farm which is oriented in a single direction, the multi-angle orientation parameter from the solar tree panels yields the potential capability to absorb higher sunlight intensity leading to higher output energy. At the same time, this parameter eliminates the necessity to install solar tracker which can reduce the operational cost. To increase the collection Generation of 1MW power from PV module system requires the land of 5-6 Acres approximately for housing the panels only. A tall polelike structure would take only 1% of land area in comparison to general PV housing. In India there is scarcity of land in urban and even in rural areas. It can also be locked at any position to withstand the wind pressure due to heavy storm affecting over the main pole/trunk. The panels will be naturally facing towards the sun at an angle as required so that they can collect maximum solar energy in a daytime. To get the maximum sun in a day time the top panel should not obstruct the bottom panels.

**Working Principle:**
Solar tree can be designed both for standalone and in synchronization with the power grid. It uses the generated energy form the solar panels and store the energy to the battery by a DC Charge controller. The controller may MPPT or PWM type. During the daytime when the sunlight is sufficient to meet the loads, the generated solar energy directly feed to the loads. Any excess solar energy after meeting the loads should be stored in the battery. The stored energy into the battery can be utilized when the generation from the PV is not sufficient. The inverter has proposed here to convert DC power to AC as most of the common appliances are AC and also facilitate to charge the Mobile, laptops under the shade of the solar tree. The Solar tree used for lighting purpose is a sensor based lighting system. The automatic control and monitoring unit monitor the Solar panel output and at dusk, the solar tree switches on LED automatically. A sensor measure the amount of light at atmosphere and triggers the switch on automatically at sunset and off at dawn.

**Solar tree around the world:**
By conducting surveys and exhibitions of different models of Solar Trees presented by many researchers can make a good platform for the progress of this technology. The solar tree - the new symbol of Gleisdorf – was built in 1998 with a capacity of 7 kWp and was connected to the public electricity grid. It stands in the "solar street" which is a 3.5 km long street section, where about 80 objects are powered by photovoltaics, such as a public solar clock, advertising boards and street lights. Solar cells have also been used for art and the solar tree is one of these examples. It is 17.3 meters high and consists of a 12700 kilogram solid steel sculpture in the form of a tree with five branches holding 140 solar panels. The tree generates approximately 6650 kWh of electricity annually which can supply about 70 city streetlights in the centre of Gleisdorf.

**Ross Lovegrove's Solar Tree:**
Ross Lovegrove, a Welsh industrial designer known for his organic designs and designs, conceived an organic-looking solar structure with multiple curve stems and circular collections of photovoltaic cells. It was first manufactured by Artemide, a manufacturer of differentiated design products, based in Milan, Italy. Ross Lovegrove’s original design consists of a sinuous tree constructed of steel pipes, measuring 5 meters, supporting a light bubble in which 38 solar cells, each with 38 watts of power, connected to a hidden 12V battery system which includes 1W LEDs at the tip. The solar cells for the project were commissioned by Sharp Solar. Spotlight Solar structures: In 2011, Spotlight Solar introduced a line of architectural products which customers refer to as solar trees. They offer four different model of solar tree: Lift, Curve, Trestle and Industry.

**Technical Specification:**
Solar PV Modules The Solar PV modules which have been supplied are minimum declared output of 100Wp at STC. The modules are IEC 61215 and IEC 61730 certified. The tilt angle and the azimuth of the module for this location are different and it is distributed throughout 360° angle. Modules are made of crystalline silicon Solar cells. The SPV Modules has been tested & certified by an independent international testing laboratory. The module frames should be made of corrosion resistant material, which shall be electrically compatible with the structural material used for mounting the modules. The modules have been provided with a junction box with provision of external screw terminal connection and with arrangement for provision of by-pass diode. The box should have weather proof lid with captive screws and cable gland entry points.

**Module Mounting Structure**
The module mounting structure designed for this project is very innovative and challenging as the load bearing capacity should be calculated accurately for preventing any future difficulties. The main challenge of designing the structure is the stability maintaining the aesthetic view. The mounting structure is designed for holding 10 to 15 numbers of modules of 100 Wp. The weight of the module is approximately 8kg/Module. The frames assembly of the array structures should be made of 80 micron Galvanized Iron. Most photovoltaic modules are designed to last 20 years or longer. It is important that the other components in the system, including mechanical components, have lifetime equivalent to those for the PV modules. It is also important that the mechanical design requirements of the system be consistent with the performance requirements as well as with the operational requirements of the system. The mechanical
design of photovoltaic systems cuts across a variety of disciplines, most notably civil and mechanical engineering and, to a lesser extent, material science, aeronautical engineering and architecture. More specifically, our mechanical design involves:

- Determining the mechanical forces acting on the system.
- Selecting, sizing and configuring structural members to support these forces with an adequate margin of safety.
- Selecting and configuring materials that will not degrade or deteriorate unacceptably over the of the system.

**The Salient feature of Solar tree Structure:** The structures shall be for Design of Optimized Solar Tree for the different city of Jharkhand. The structure shall be designed to allow easy replacement of any module and shall be in line with the site requirements. Height of the module from the ground should be minimum 2.5 Meter Outfitted with a water sprinkler at the top for self-cleaning the panels. The structure shall be completely made up of Stainless Steel SS 304. The foundation for Solar Tree structure shall be preferably 1:2:4 PCC constructions or any other combination based on the local site condition requirement for which design details shall be submitted and approved before start of work. The support structure design and foundation shall be designed to withstand wind speed up to 150 kmph for which design details and drawings shall be approved. In general, bolt, nuts, shims, Fasteners and other hardware should be of stainless steel SS304. Structure should be designed so as to make the solar panels easily accessible for cleaning/ wiping. The solar tree structure should also contain enclosure made of Stainless Steel SS 304 for housing batteries and charge controller to prevent it from rain and other natural calamity. The battery housing shall consist of a platform which may be used for sitting purposes. All the drawings/design must be approved from JREDA officials before the start of work.

**Charge Controller Unit**
The Solar Charge Controller shall be microcontroller operated MMPT based technology and should be designed to execute the important functions of charge and discharge management of 48 VDC batteries.

- Suitable rating of Charge Controller to be provided based on the bank.
- This charge regulator allows the photovoltaic system to operate efficiently and prevents the batteries from any electrical shock or damage, improving consequently their average operating lifetime.

The Solar Charge Controller should be designed for simple small-size stand-alone systems, is produced using advanced solid-state (MOSFET) and Microprocessor technologies. These technical features warrant to this charge regulator high reliability and a long average operating lifetime.

**The main technical features of Solar Charge Controllers are:**

- Control of the maximum charge of the battery by means of a steady-voltage charging
- Display of the state of low battery by Red LED.
- Display of the present charging mode of the battery with Green LED.
- Protection of the load output (electronic, resettable) against short circuit, overload and polarity reverse,
- Temp. Compensation
- The charge controller and the Battery for loads are preferably to be housed/mounted inside the SS 304 Enclosure on the Smart Tree. The requisite output and inputs from SPV is to be made with suitable sockets only.

**Problem Identification:**
Due to less land requirement It require less land as compare to traditional PV system. So we require such a plant which can generate maximum energy using minimum land. Main problem is solar panel won’t work in dark. Overcome this is very needy. As setup for solar tree is quite costly as compare to rational solar placement so this could be used so wind turbine on same setup. Wind turbines are rarely found in cities though it is also a free energy source of energy.

**Objective:**
“Use traditional free source of energy in untraditional way to increase efficiency of energy generation” is the main objective of the proposed work. Secondly we have to reduce the land area used to be engaged in traditional solar system setup. To generate energy even in night with the help of wind turbine place on solar tree.

**Proposed work:**
In this work, we have presented our thought that Solar Tree concept for domestic electrification is big step to reduce electricity bills and dependence on grid power which is unreliable nowadays in India. It also provides clean energy source to reduce the global warming. Energy demand (load) of the small family is considered and taken for determining the capacity of proposed system and system component sizes. It can generate energy very efficiently as compare to traditional system.

**Block Diagram:**

![Block Diagram](http://ijesc.org/)

**Structure**

In this system we are connecting solar panel on tree like structure along with wind turbine.
II. CONCLUSION:

So as per the study on proposed system we are pretty much sure about the solar tree with wind turbine will be the best solution to generate energy day and night. Tree structure like design will most efficient than the traditional one. 3 solar panel of 15W each will be used along with wind turbine. Combinedly 45W will be produced. In addition to that 12W will be generated by wind. Overall 57W will be generated. 12Volt 7Amp battery will be charged within few hours.

III. REFERENCES

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