Idea to Design a Solar Tree Using Nanowire Solar Cells

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Abstract- This paper introduces a new solar technology that emulates how trees convert sunlight into energy. Trees, shrubs and plants use an inherent structural design to expose their leaves, height dense to sunlight for photosynthesis. They do this determines their survival. Based on this we describe the coconut tree growing u to 30m(98 feet) tall, with pinnate leaves 4-6m(13-20feet) long to design a solar tree. Pinnate refers to a leaf resembling like a feather having the leaflets on each side of a common axis. It can be either even or odd. By this structured pattern that leaves follow to arrange themselves on a tree. With this arrangement we introduce a new idea to design a solar tree using nanowire solar cell. Nanoparticles exhibit a number of special properties relative to bulk material. A single Nanowire concentrates the sunlight upto 15 times of the normal sunlight intensity. Surprising results have the potential for developing a new kind of highly efficient solar cell. Nanowires possess some distinctive physical light absorption properties. Because of these properties, the limit of how much energy from the sun's rays we can use is higher than previously thought. For many years it has been a high mark for solar cells efficiency among researchers, but now there is possibility that it may be raised higher. Hence it is a revolutionary urban lighting concept that not just trees but other objects can also be decorated. These technologies eventually lead to the development of high efficiency solar cells

Index Terms- Solar tree, Nanowire solar cell, street light design

I. INTRODUCTION

Energy consumption in the world particularly in the industrialized countries has been growing at an alarm rate. Fossil fuels which today meet major part of the energy demand are being depleted quickly. World has started running out of oil and it is estimated that 80% of the world's supply will be consumed in our lifetimes. Coal supplies may appear to be large but even this stock may not last longer than a few decades. Nuclear power has posed a number of problems and nuclear fusion is still a speculative technology. Thus we are forced to look for unconventional energy sources such as geothermal, ocean tides, wind and sun. It is also hoped that these alternative energy sources will be able to meet considerable part of the energy demand in coming future. Among all these solar energy seems to hold out the greatest promise for the mankind. It is free, inexhaustible, nonpolluting and devoid of political control. Solar water heaters, space heaters are already on the market and seem to be economically viable. Solar photovoltaic cells, solar refrigerators, solar thermal plants will be technically and economically viable in a short time. It is optimistically estimated that 50% of the world power requirements in the middle of 21st century will only come from solar energy.

II. SOLAR POWER

The sun gives out $3.7*10^{26}$ watts of energy into space, out of which earth intercepts only $5*10^{-10th}$ part of the solar energy output. The energy intercepted by earth is equivalent to $1.7*10^{17}$ watts. The energy emitted by the sun within three minutes is equivalent to the world energy consumption during a year. Most of the solar radiation reaches earth as electromagnetic waves of about 0.25 to 3μ wavelength. Solar energy is unique source of energy which can be exploited in many different ways as one such way is

i) By direct conversion to electricity by photovoltaic.

A) Photovoltaic conversion:

In Photovoltaic conversion, solar radiation falls on semiconductor devices called solar cells which convert sunlight directly into electricity. When light falls on the junction between two types of semiconductor called p-type and N-type-type has an excess of electrons and P-type has a shortage of electrons. When a bright light shines on a cell, energy from the light(photons)enables electrons to break free from the junction between them. This is called photoelectric effect. The flow of electrons constitutes an electric current stored in batteries.

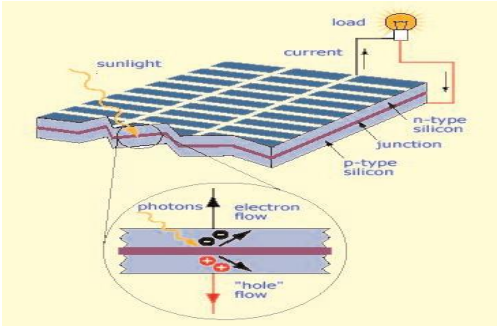

Fig.1 Photovoltaic effect

III. SOLAR CELL-NANOWIRE BASED SOLAR CELL

Nanowires are made of semiconductor material Indium phosphide- Commonly used as substrate for epitaxial InGaAs. Superior electron velocity, used in high-power and high-frequency applications. It works like antenna thatabsorb sunlight and generate power. Nanowire crystal has cylindrical structure with diameter of about 10,000 part of a human hair.

Development not only of solar cells but also of future of quantum computers and other electronic products. Due to some unique physical light properties of nanowires the limit of how much energy we can utilize the sun's rays is higher than previous believed. The nanowires are predicted to have great potential in the development not only for solar cells but also for quantum computers. It turns out that nanowires naturally concentrate the sun's rays into a very small area in the crystal by upto a factor 15.Because the diameter of nanowire crystal is smaller than the wavelength of light coming from the sun it can cause resonances in the intensity of light in and around nanowires. Thus the resonances can give a concentrated sunlight where the energy is converted which can be used to give a higher conversion efficiency of the sun's energy.

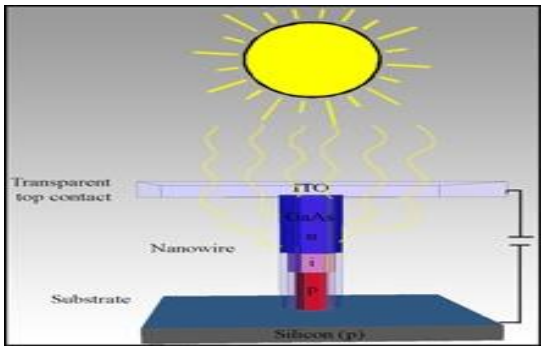

Fig-2 Nanowire solar cell

Advantages: Little maintenance, Longer life, Not create pollution problem, Easy maintenance, Good efficiency.

IV. IDEA TO DESIGN SOLAR TREE

SOLAR TREE:

It is a combination of artistic and technological effort which exists as a form of solar artwork. This relatively new concept was conceived in an attempt to merge new technology relating to the absorption and use of solar power. Since the angle of sun's rays is not fixed, particularly during the changes in seasons, the panels for homes are inefficient. Some residential solar systems are designed to move and track the sun but these systems substantially increase the cost of solar energy because they are expensive and require maintenance. So we designed a solar tree using an array of solar panels of nanowire solar cells as leaves. The solar cells on the tree were able to store enough electricity in spite of receiving no direct solar light for days at a time because of the clouds. Solar trees were really a practical form of street lightning.

We planned to design green stems constructed of steel pipes supporting a light bubble in which solar cells are connected. In place of branches we use solar panel which has to produce voltage. The design copied from the pattern of coconut tree as closely as possible. Battery is hidden at the ground base which is closed with proper material. The branch of the solar tree was decorated with LED lights at the tip.

LIGHT BUBBLE:

Alight bubble is a decorative device consisting of a liquid filled vial that is heated and lighted by an incandescent light bulb. Because of the low liquid's boiling point the modest heat generated by the lamp causes the liquid to boil and bubble up from the vial's base thus creating the bubble light.

V. WORKING OF SOLAR TREE

Storing of electric energy is a major problem for all electric power system. Ways to eliminate solar cell output fluctuations caused by the day and night cycle and weather shifts. Despite of energy loss, which can be high as 50% with present batteries. Solar tree panels charge batteries during the day. At dusk the solar tree automatically switches on its led..The internal control can also regulates the amount of light produced on how much charge is left in the batteries.Asensor is used to measure the amount of light in atmosphere and triggers the solar lamps to switch ON automatically at sunset and OFF at sunset.

Fig-3 design model of solar tree

VI. CONCLUSION

The solar new technology presented in this paper will provides nearly high efficiency. The number of papers and patents published in this area has grown up exponentially over the last 10 years. However at the present, research efforts have largely focused on solar trees. Nanowire can concentrate the sunlight upto 15 times of the normal sunlight intensity and hence the surprising results have the potential for developing a new kind of highly efficient solar cell. This can be used to give a higher concentration efficiency of the sun's energy.

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