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**SOLAR AC POWER GENERATION WITHOUT INVERTER**Prof. V. A. Ghodeswar<sup>\*1</sup>, Prof.P.S.Dorale<sup>2</sup>, Prof. S. S.Bhuskute<sup>3</sup>, Prof. C. E. Morkhade<sup>4</sup> & Mr. R. N. Awasthi<sup>5</sup><sup>\*1,2,3,4&5</sup>Department of Electrical Engineering, MGI-COET Shegaon**ABSTRACT**

Renewable energy resources are the major demand of the day. As fossil fuels are limited so we just can't rely on them especially in this new age where the demand of energy has increased drastically. Solar energy can be one of the effective renewable energy sources. This is a new way of looking at a solar panel that we can generate alternating current directly from photovoltaic cells. We can use an array of photovoltaic cell pairs that are connected in anti-parallel form to create an AC wave form. Solar panels today produce DC power which has to be firstly converted into AC to be mostly used in business and home appliances. Solar panels become very expensive when we add solar panel's price joint with the price of inverters and phase synchronizers. In addition to that the power losses of different components that are used in the DC to AC converters so it becomes even more unappealing. We show a new technique for the generation of AC power from Solar panel by avoiding the inverter and thus by adopting this technique we can remove power losses due to an inverter. There is no need of batteries in our technique so overall cost is also reduced. Another very good aspect of this technique is that we get a very pure sine wave of better efficiency than that of an AC inverter. We can generate the sine wave of any frequency by just controlling the speed of motor used in this technique. So it is a very simple technique with great effects.

*Keywords: Solar cells , Anti parallel connection ,Inverter, Disc.*

**I. INTRODUCTION**

Today AC power is produced for the power grid by AC generators. The generators are powered by mechanical energy provided by water turbines (hydroelectric) or steam turbines powered from coal, natural gas or nuclear fuel. The mechanical energy rotates the coils of the generator in a magnetic field to produce voltage. Because the conductor coil of the generator flips direction during rotation in the magnetic field the resulting voltage [1]. We can convert sun light into electricity in many ways like it can be converted by using solar cells or with concentrated solar power (CSP), in which we throw the amplified sunlight to boil the water which can then be used to produce electricity. In this work we are using these solar cells in such a way that they can directly produce AC. So now we don't need those expensive inverters we can just directly use Solar cells to produce AC current. We can also control the frequency of the sine wave as well just by controlling the system. And the best thing about this system is that it can produce a pure sine wave better then then that what we get from an AC derive or inverter [2].

Existing solar panels do require extra instruments so they firstly get converted from direct current (DC) electricity to alternating current (AC) electricity.

Inventive Research replicated this sinusoidal voltage by mechanically manipulating alternate banks of solar cells to turn off and on. They spent many years developing this technology. They call it the AC Solar Generator. It's so simple and practical you won't believe it hasn't been done before, but it hasn't. The process used to do this is simple but pure genius in its application. Half of the cells are wired in one circuit and half in another circuit Mounted above the solar cells is a spinning disk powered by a DC electric motor. The DC motor gets its power from four small DC solar cells mounted in the corners of the base. The disk has portals cut into it allowing light to pass through to every other solar cell below it. As the disk spins each of the banks of solar cells is alternately exposed to light and alternately produce power. When the portal is half way between the two cells the voltage cancels and drops to zero.

Other benefits include:

1. Generates free energy from the sun.
2. Nonpolluting energy reduces emissions: Has no direct impact on the environment.
3. It's easily scalable.
4. Grid Tie systems allow you to sell excess electricity back to the utility.
5. Can be installed and operated anywhere including areas of difficult access and remote locations.
6. Helps get us off dependence on foreign oil.
7. PV cells make no noise and give off no exhaust[1]

This is truly a transforming technology. The AC solar generator has the potential to reduce the use of fossil fuels tremendously if you just imagine them installed photovoltaic solar power centers around the country generating supplemental power for the grid [4].

The objective of this presented work is to reduce the cost of the Solar Power Generation by eliminating the Inverter, Converter etc. In this we are using technique to generate the AC voltage directly from the Photovoltaic Cell without using Inverter. The spinning disk mounted above the solar cells and this disk is rotated with the help of a DC motor. The DC motor gets its power from the Battery. The disk has portals cut into it allowing light to pass through to every other solar cell below it. As the disk spins each of the banks of solar cells is alternately exposed to light and alternately produce power. When the portal is half way between the two cells the voltage cancels and drops to zero. The resulting voltage is sinusoidal or AC. It can even be configured to produce three phase AC power.

The prototype is meant only to show the concept in practical use and is not the most efficient way the technology could be applied. Given the right manufacturing technology the solar cells could be made in the shape of a pie wedge. When arranged in a circle next to each other they could generate power from the entire area under the rotating disk and not just a portion of the area as shown in the prototype. The optimum size might be about the same size as a compact disk. These small units could be combined to form a full solar panel as shown in the images.

This is truly a transforming technology. Generation of electricity from the solar energy has the potential to reduce the use of fossil fuels tremendously. Existing technology requires solar energy to be converted from direct current (DC) to alternating current (AC) before it is compatible with the Nations Power Grid. The AC Solar Generator seeks to achieve the same result at a lower cost and with less energy loss by producing alternating current directly instead of relying on additional equipment. The prototype device used to demonstrate the process consists of solar cells arranged into a circular pattern mounted on a base. Above the solar cells is a spinning disc with slots which controls each cell's exposure to light and darkness. The resulting voltage is AC that can be configured to three-phase power usable with the national power grid. We can convert sun light into electricity in many ways like it can be converted by using solar cells or with concentrated solar power (CSP), in which we throw the amplified sunlight to boil the water which can then be used to produce electricity. In our project we are using these solar cells in such a way that they can directly produce AC [3].

## II. NEED OF SOLAR AC GENERATOR WITHOUT INVERTER

The demand and need for clean and renewable energy is becoming more urgent as earth undergoes global climate changes. Generation of electricity from coal produces over 50% of the carbon dioxide released into the atmosphere each year. Coal and other fossil fuels will also eventually run out. The hydroelectric power generation of electricity is limited to places where there is an adequate water source. Nuclear energy for the creation of electricity has the drawback of creating nuclear waste [5].

However, one type of clean renewable energy is solar energy or sunlight. Solar energy is a constant source of clean energy that can shine on all areas of the surface of the planet. Solar energy or sunlight can be converted into electricity by a photovoltaic cell. A photovoltaic cell known as a solar cell captures and converts sunlight into electricity. A solar cell is made from a semiconducting material (a semiconductor) such as silicon that absorbs the sunlight which generates a flow of electricity through the solar cell. Because of the properties of semiconductors,

positive and negative terminals of the solar cell are static and electron flow from a solar cell is unidirectional (i.e. the electricity can only flow in one direction). Thus, as with all photovoltaic cells, the solar cell produces only direct current (DC) electricity. The problem with direct current electricity is that direct current electricity is difficult to transmit any appreciable distance, which limits their use. Thus, alternating current electricity is more usable than direct current electricity. Moreover, most electrical devices utilize alternating current (AC) electricity [5].

Existing solar panels do require extra instruments so they firstly get converted from direct current (DC) Electricity to alternating current (AC) electricity. The AC solar Generator can achieve the same result at a lower price and with even less energy losses just by producing alternating current directly from solar cells then by using extra circuitry. The prototype device which is used to exhibit this process has an array of solar cells that are arranged in a circle, a base and a disk on top of them which has holes that are used to control each cell's exposure to sun light and darkness. This AC is achieved by controlling the disk and ultimately controlling the shaded and exposed areas of the solar cells. So we can call it a Smart Solar AC Generator without inverter.

### **III. CIRCUIT DISCRPTION**

#### **a. Panel Arrangement**

The solar cell a/c electricity generator has a base that supports the various components. The base may be formed of wood, plastic or other suitable material which is preferably, but not necessarily, a non-conducting material. The base includes an alternating current electricity production portion formed by a disc and a plurality of photovoltaic or solar cells [4].



*Figure 1 Panel Arrangement*

As best seen in Figure 1 above, the plurality of solar cells are arranged in a generally circular array on an upper surface of the base. It should be appreciated that arrays other than circular may be used within the present principles. It should also be appreciated that while the solar cells are shown as rectangles, the size and shape of the solar cells may be otherwise, such as truncated conical, triangular, polygonal or square [4].

#### **b. Disc Arrangement**

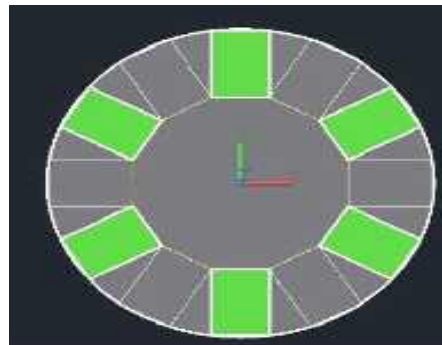
As best seen in figure 2 the disc has a generally flat body made of a sunlight blocking material that is generally the circumference of the solar cell array in order to extend over the solar cell array when in use. The disc is also preferably made of a lightweight material that resists warping or is not susceptible to warping. It should be appreciated that the disc may be partially reflective or non-reflective if desired. The disc has a plurality of cutouts, openings, or windows formed. The size and shape of the cutouts generally correspond to the size and shape of the solar cells and particularly is sized and shaped to allow total exposure of a solar cell to sunlight when the cutout is positioned over the solar cell. The cutouts are situated and spaced on the disc so as to define a plurality of covers, coverings or blocks. The coverings are sized and shaped to completely cover or block a solar cell when the covering is over the solar cell [4].



**Figure 2 Disc Arrangement**

**c. Solar Panel Arrangement**

The connections are divided into two groups: positive and negative. The cells are arranged in such a way that alternate cells will form a positive group and other alternate will form negative group.



**Figure.3 Arrangement of Solar Panel**

For example, if cell number 1, 3, 5 etc. forms a positive group then cell number 2, 4, 6 will form a negative group. Red symbolizes positive while black symbolizes negative groups from the figure 3 above. Horizontally, cells are connected in series.

Cells in the first row are connected in parallel with the cells in the second row. This together forms a positive group. Similarly, cells of third and fourth rows are connected in parallel and this forms the negative group. The number of cells can be increased as per the requirement. Now, the two groups which are formed i.e. positive and negative are connected in series opposition which actually brings the voltage to zero and gives the required sinusoidal alternating output [4]. i.e Anti parallel connection shown into figure 4.

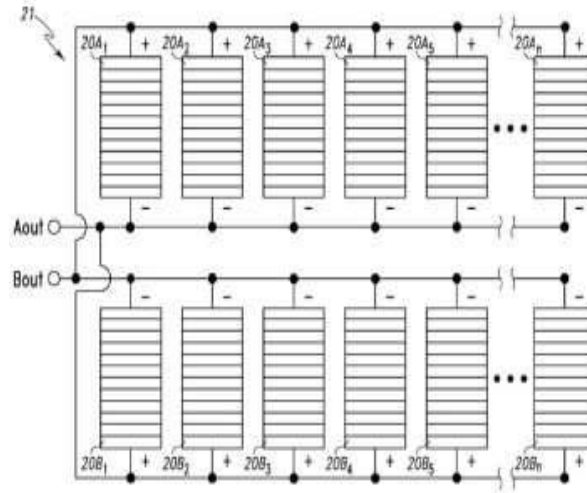


Figure 4 Antiparallel connection

#### IV. WORKING

We can convert sun light into electricity in many ways like it can be converted by using solar cells or with concentrated solar power (CSP), in which we throw the amplified sunlight to boil the water which can then be used to produce electricity. In our project we are using these solar cells in such a way that they can directly produce AC [5].

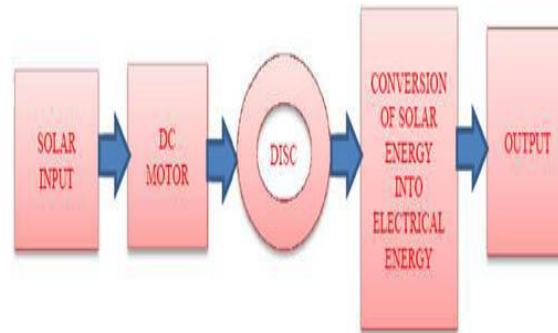


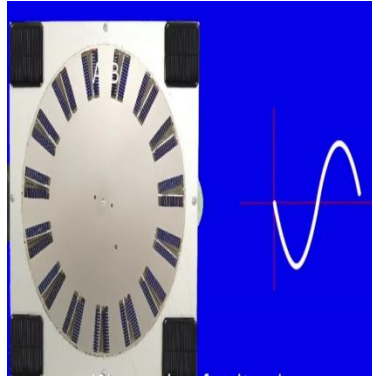
Figure 5 Block Diagram of project

So now we don't need those expensive inverters we can just directly use Solar cells to produce AC current. We can also control the frequency of the sine wave as well just by controlling the system. And the best thing about this system is that it can produce a sine wave better than that what we get from an AC derive or inverter.

When arranged in a circle next to each other they could generate power from the entire area under the rotating disk and not just a portion of the area as shown in the prototype. The optimum size might be about the same size as a compact disk. These small units could be combined to form a full solar panel. This is truly a transforming technology. Generation of electricity from the solar energy has the potential to reduce the use of fossil fuels tremendously. Existing technology requires solar energy to be converted from direct current (DC) to alternating current (AC) before it is compatible with the Nations Power Grid. The AC Solar Generator seeks to achieve the same result at a lower cost and with less energy loss by producing alternating current directly instead of relying on additional equipment. The prototype device used to demonstrate the process consists of solar cells arranged into a



circular pattern mounted on a base. Above the solar cells is a spinning disc with slots which controls each cell's exposure to light and darkness. The resulting voltage is AC [5].



*Figure 6 AC generated from solar AC solar generator*

If we are using number of pair in the even number then, we can't place the PV cell A & B in front of each other it should be near to each other. If we are using number of pair in the odd number then we can place the PV cell A & B in front of each other. It is necessary for cutting the disk to bring the PV cell A & B alternately in proper way.

The operation of the system is divided into four mode of operation for understanding the concept of generation of AC waveform. In the above figure 6 PV cell A generate the positive voltage and PV cell B generate the negative voltage. It can be decided with the help of millimeter and connection of all pair make as per it.

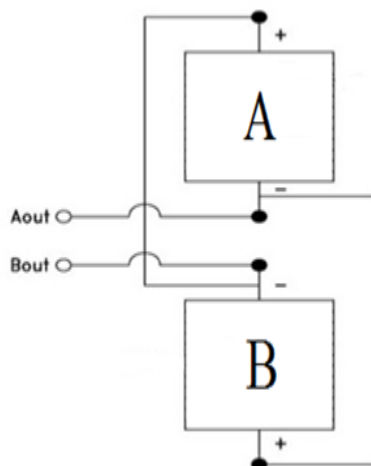
In the first mode all part of cell A is exposed in the light and all part of cell B is shaded. So the cell A generates maximum positive voltage and cell B generate zero negative voltage. So the output voltage is maximum positive voltage [5].

In the second mode left side half part of cell A is exposed in the light and right side half part of cell B is expose in light. So the cell A generates 50% positive voltage and cell B generate 50% negative voltage. So the output voltage is zero.

In the third mode all part of cell A is shaded and all part of cell B exposed in the light. So the cells B generate maximum negative voltage and cell A generate zero positive voltage. So the output voltage is maximum negative voltage.

In the four mode right side half part of cell A is exposed in the light and left side half part of cell B is expose in light. So the cell A generates 50% positive voltage and cell B generate 50% negative voltage. So the output voltage is zero.

Due to rotating the segmented disk the cell A & B expose and shaded gradually. So the output voltages gradually increase and decrease. The result of this method is AC waveform. The frequency of the output voltage is depending on the number of PV cell pairs and number of segment on the disk [5].



*Figure 7 Anti-parallel connection of two solar cell*

In the above figure 7 two PV cell which having same ratings. Number of pairs are connected in array to generate the AC power directly from the solar energy. The array of solar cell are placed in the circular manner. The small DC motor is placed in the center of the circular array which is used to rotate the disk. The rotating disk having the segment to expose and shaded the PV cell from the light.

If we are using number of pair in the even number then, we can't place the PV cell A & B in front of each other it should be near to each other. If we are using number of pair in the odd number then we can place the PV cell A & B in front of each other. It is necessary for cutting the disk to bring the PV cell A & B alternately in proper way.

The operation of the system is divided into four mode of operation for understanding the concept of generation of AC waveform. In the above figure 7 PV cell A generate the positive voltage and PV cell B generate the negative voltage. It can be decided with the help of multi-meter and connection of all pair make as per it.

In the first mode all part of cell A is exposed in the light and all part of cell B is shaded. So the cell A generate maximum positive voltage and cell B generate zero negative voltage. So the output voltage is maximum positive voltage.

In the second mode left side half part of cell A is exposed in the light and right side half part of cell B is expose in light. So the cell A generates 50% positive voltage and cell B generate 50% negative voltage. So the output voltage is zero.

In the third mode all part of cell A is shaded and all part of cell B exposed in the light. So the cell B generates maximum negative voltage and cell A generate zero positive voltage. So the output voltage is maximum negative voltage.

In the four mode right side half part of cell A is exposed in the light and left side half part of cell B is expose in light. So the cell A generate 50% positive voltage and cell B generate 50% negative voltage. So the output voltage is zero.

Due to rotating the segmented disk the cell A & B expose and shaded gradually. So the output voltage gradually increases and decreases. The result of this method is AC waveform. The frequency of the output voltage is depend on the number of PV cell pairs and number of segment on the disk [7].

**V. RESULT AND DISCUSSION****a. Proper ac waveform**

Mechanically exposing and covering the photovoltaic cell pairs gradually, alternating expose and cover the two anti-parallel solar cells. It results in a sinusoidal AC wave form. The resulting sine wave is periodic. The rate at which the exposing and shading is done determine the frequency of the sine wave.

**b. output**

We get the following output from a single ac solar generator. The resulting Sinusoidal wave form has peak voltage and frequency given in table shown below.

*TABLE: I Analysis of ac solar power generated*

Peak-to-peak voltage	7 V
Peak voltage	3.5V
RMS voltage	2.47V
Frequency	40Hz

Solar energy is the need of the day as the demand of energy is increasing day by day and we need clean and free energy. As fossil fuels are limited and most of them are not environmental friendly so solar is the best solution of our energy crises. There are many techniques to use solar energy but the best and most easily implemented at any place is to generate electricity using solar cells. But the problem with solar cells is that they produce DC electricity so we have to firstly convert it in to AC using inverter. Inverter makes that setup more expensive and decreases its efficiency. To counter this problem a mechanical setup is used which directly generates AC from the solar cells cell array which is less expensive and can have almost same efficiency as inverter. But it has its own limitations like the size of the solar cells should be small and a proper sheet should be used as base and spinning disk. Its efficiency is quite low but it will get better when tracking system will be used. We will try to reduce weight and frictional losses too.

It is a new technique and after some more modifications we can make it better so that it could come in domestic use. Like if we use small solar cells with more power it will become very effective. Also the solar tracking will improve its output because using tracking solar will capture sunlight completely not at an angle which will create its own shadow. We can compare the efficiency of this system with current systems.

**VI. ADVANTAGES AND DISADVANTAGES****a. Advantages****1 No requirement of inverter**

In case of conventional solar power generation, inverters are required to convert the generated DC power from solar panel to AC power but in this project there is no requirement of as AC power can be generated.

**2 Reduction in high cost of inverter**

As there is no requirement of inverter so the high cost of inverter is reduced, number of solar cells can be increased in order to increase generation capacity.

**3 Efficiency is more**

The switching losses occurred in typical plant due to inverter is reduced in this case and thus the efficiency of this project is increased.

**4 Increased reliability and flexibility**

The reduced use of inverter thus enhances the use of more number of solar cells to increase the power generation capacity of the project thus improving the flexibility and reliability of the project.



**b. Disadvantages****1 Required maintenance**

In this case use of the DC motor to rotate the disc needs maintenance in order for its smooth operation during peak hours of power generation.

**2 Bulky size and high in cost**

The small capacity of this type of generation is high in cost but as higher the capacity of power generation the lower the cost of project and size of this project is large thus by proper research the size of this project can be reduced.

**VII. CONCLUSION**

Solar energy is the today's need as the demand of energy is increasing day by day. The problem with solar cells is that they produce DC electricity so we have to firstly convert it in to AC using inverter. Inverter makes that setup more expensive and decreases its efficiency. To counter this problem a mechanical setup is used which directly generates AC from the solar cells cell array which is less expensive and can have almost same efficiency as inverter. But it has its own limitations like the size of the solar cells should be small and a proper sheet should be used as base and spinning disk. Its efficiency is quite low but it will get better when tracking system will be used. We tried to reduce weight and frictional losses too. It is a new technique and after some more modifications we can make it better so that it could come in domestic use. Like if we use small solar cells with more power it will become very effective. Also the solar tracking will improve its output because using tracking solar will capture sunlight completely not at an angle which will create its own shadow. We can compare the efficiency of this system with current systems.

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