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OPTIMIZING THE EFFICIENCY OF SOLAR PHOTO VOLTAIC SYSTEM

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Abstract- India is an energy deficient country, where a large fraction of the population still does not have access to modern day energy services such as electricity. This is due to very limited fossil fuel resources and poor economy, which restrains the import of fossil fuels on a large scale. To overcome energy shortage, India needs to develop its indigenous energy resources like hydropower, solar and wind. India lies in an area of one of the highest solar insulation in the world. Accordingly, the status and outlook of solar energy use in India are discussed. It is concluded that the current infrastructure has not been able to advance the status of solar energy in India. Significant efforts are needed to effectively utilize this cheap renewable energy source. Solar power is a term that refers to several alternative sources of energy by which sunlight is harnessed to do useful work for mankind. People know that it is energy since the same alone implies this, but many people think it is expensive and not a preferred method of producing energy. We need to find out how cost effective it is how useful solar power technologies involves the use of photovoltaic cells.

Key Words: Solar Energy, Solar Cell, Solar Collectors, Solar Electric Power

I. INTRODUCTON

The worldly capacity of acting is multiplying as the whole Habitants remain to increase in size greatly remaining and having life standard are rising everyday on the other hand, we are presenting greatly depending on our finite assets of oil about 10 decades. Since some of the pecuniary means are merely advantageous in few areas of the world. A part is from the risk associated with a shortage of combustible matter the use of these capacity mediums multiplies Carbon Dioxide emitting. Nuclear energy has been supposed to decrease Carbon Dioxide emitting. But it is unreachable for a number of other causes initially because of the high price risk of nuclear proliferation and decommissioning of the nuclear waste uranium advantageous. Nuclear capacity will only available for nearly another 81 years. Energy proficiency steps are one of the most effecting sources of lowering these negative effects. Renewable capacities as such a wind power. Water, Biomass and efficient and inefficient Sun capacity of acting, have power to hold grip these problems as they are unlimited and don't produce any sum of Carbon dioxide due to the decentralized division of nature of most the capacity of acting advantageous. The dependence of the electric energy supply from renewable powers are usually higher than that from traditional energy sources[1]. The energy demands and the electric power generation from, renewable energy sources, Especially from single silicon photovoltaic cells (SPV cells) follow same every day patterns top during the middle of the day. If excess power is generated it can be sent to the electricity or saved in batteries, etc. "particularly for standalone setup." [2]. Comparatively high prices are inhibiting the worldwide spread of stretches of renewable capacities of acting and particularly of silicon photovoltaic cells (SPV cell) this reflects the imbalance of external prices that are generally not fully counted in the cost. These prices are, at times very hard to get, even they can be the countless consequences of environmental destruction, the effects of climate change. For all its qualities, there exist two major challenges for photovoltaic cell. In order to lower the price per watt, photovoltaic cells need to become less costly and easier to benefit the global spread stretches for many systems. Present technologies need to get better and new methods searched. In this struggle we are concentrating on electric power production and on the performance increment of photovoltaic cells, especially for the new technology of sole crystal silicon photovoltaic cell. Sun rays descend the earth upper condition at a price of 1367 (W/m2) [3]. The first map shows how the sun's heat converts in many behaviors. While passing through the space, 5% of the descending Sun's beams (insulation) are passed and 15% are busy consequences of high radiation at the equator of 1,020 W/m2 [5]. Amount atmospheric situations (clouds, dust, pollutants) lesser insulation by 22% by spreading 4% via entrance [6]. Atmospheric conditions not only decrease the quantity of insulation. Reaching the Earth's surface but also harms the quality of insulation absorbing incoming light and changing its color. The second picture shows the average worldly heat considered from satellite data from 1993 to 1995. For pro-type, the North America, the heating low whole time including nights and times of cloudy weather lies between 120 and 370 w/m2. This shows that available energy, taken electricity. Now, photovoltaic panels typically change about 15% of happening/control board same in the world, on common delivers to 21 to 58 W/m2. The black disc in the third map on the right is an example of the land areas that, if place over 9% control board, solar generate first power in 2004. Quantity filling, power of ability, energy ability concerned situations of ability at a specific place. People regularly utilize energy to get fire. Recently relates world is darkening, an impact of solar energy from the day light, items heating conversion, tolls of sun power due to the permanent capacity in future getting less in supplied sun energy. [7]

II. LITERATURE SURVEY

There are different solar collector systems used for Solar Electric Power and Generation (S.E.P.G), the commonly used one is concentrator collector and Flat-plate Collector due to its low cost design, easy installation and effectiveness in cloudy day. In order to improve the efficiency of Flat-plate Collector, selective coating on the appropriate surface would be such that it absorbs maximum Solar Radiations with minimum emission of long Wave Length Radiations. For this purpose, different types of coating, e.g., semiconductor coating dielectric coating and metallic coating has been used on sucker plate of collector. Their optical, structural and electrical characteristics were studied to find out improvement in heat absorption [8].

2.1HISTORICAL SURVEVY Nicholas de Saussure (1740-1799), a Swiss naturalist, concludes the fundamental recorded experimentation in applying the solar beams for cooking use. He called his solar oven a "Heat Box", and it was composed of multiple separated glass covers positioned over a blackened surface. The bottom-land sides of the open were surrounded with insulation, it was recorded that the oven achieved a temperature of 160 ^{0} C. Saussure did, indeed, use the solar oven to prepare food. A slightly different solar oven was introducing in 1837 by an astronomer from U.K. John Fredrick Herschel. But the son of German born astronomer Sir William Herschel, john Fredrick constructed a little sun stove as on a trip to Africa's Cape of Good Hope. He made it of padding. A twice glazed wrap, the only part of the tool is left uncovered, served to reduce loses through apex, as letting in the day light. The stove recorded a greatest heat of approximately 117.9 ^{o}C, and was utilized throughout out the journey by Herschel and his team to boil both meat and vegetables. One of the initial spaces heating purpose was declared in 1882 by Professor E.S. Morse, in an invention for "utilizing Sun Rays in "Warming Houses". It consisted of surface of a blackened slate under glass, fixed to the sunny side of the house, with vents in the wall arranged such that cold air in a room was let out at the bottom of the slate and the glass. This method was used to heat Professor Morse's own house in fine weather. Also at the same period the first use of Flat- plate collector is reported, but its application to water pumping system [9].

The first experiment with Flat-plate collectors began in 1902, carried out by Willie and Boyle. The Flat-plate device was a shallow box with black internal surface, a clear glass cover plate, and was cooled by some form of transfer fluid flow, usually water. Willie and Boyle, s collector used the heated water to vaporize some volatile liquid (such as ammonia, sulfur, dioxide, ether, etc.). The performance of their collector, although it was built of admittedly crude materials, was such that "even in cold, raw October weather was high enough to vaporize sulfur dioxide for the engine". Subsequent work with two–fluid engine encouraged the formation of the Willie sun power company, which built ammonia- driven solar engine system in Stlouis, Missouri, in 1904. Flate –plate collector research began in 1907 by frank shaman, of Philadelphia. Water, as usual, was used as a heat transfer fluid. Like Willie and Boyle, Shaman's system used a second fluid to drive a steam engine in the case ether. His installation was located in Tacony, Pennsylvania, and included 111.5m^2 of collection surface. A large, 956.9 m^2 system of flat collector were built at Taconic in 1911.

2.2 LITERATURE REVIEW

Many publications cover silicon photovoltaic panels (SPV panels) in several aspect and thus, only a moderately concise depiction of PV is got here. The sun panel is a semiconductor linked tool that straightforwardly changes day-light in electrical energy. It contains two semi-conducting equipment consisting a seam (Brendel. R., 1994a). A PV result is a straight change of photons in electrical energy (electricity). In P type and N type materials (semiconductor) an event photon can be riveted and electrify an electron from the valence band-leaving gap after. In the simplest PV cell, these photo generated carries are separated by the field resulting from p-type and n-type doping in a p-n junction [10].The energy band drawing of a single band-gap p-n junction cell demonstrate the PV effect. There are so many losses in apparatus. The photo produced transporters rapidly thermalize to the border of the band-gap losing energy in surplus of band-gap. Some of the transporters recombine either radioactivity emitting a photo or non- radioactivity for instance via impurity conditions. They also exist when the transporters transverse the losses junction and at the contacts. The utilizable energy is, therefore, significantly lesser than the energy of the incident photon and also lesser than the band-gap. Hence the photons with the power larger than band-gap are riveted raising the electron hole pairs. Generation of voltage by the light incidence up, on the semiconductor materials system is known as photovoltaic [11]. There are three main processes responsible for photovoltaic effect.

The sun is complex radiator whose spectrum can be approximated by a 6050 K^0 black-body. This black-body spectrum is modified by the variation in temperature across the sun dies and the effect of solar atmosphere. In outer space 98% of the total energy radiated by the sun lies between 0.25-3.0 m ranges. The earth rotating around the sun in elliptical orbit with major and minor axes differ in by 1.7 %. The earth is closest to the sun on December 21 at a distance of about $1.45*10^{11}$ m and further on June 22 at about $1.39*10^{9}$ m and subtends an angle of 32 minutes at the earth. For all practical purpose, therefore, the sun has an effective black-body temperature from the earth of 5762 K^0. The Sun's interior is much hotter and denser than its surface. At its center the temperature is estimated at $8*10^8$ to $40*10^6$ K^0 and the density at about 10^5 Kg/m^3. Total mass of the sun (a small to medium sized star) is equal to $1.6*10^{30}$ Kg. Mainly significant factor of the environment are the water substance, turbidity effect expressing the effect of haze and related scattering and the ozone content. According to recent research the hole in the ozone layer is equal to in size (area) equal to the size in Vatican City in Italy.

2.3 SOLAR COLLECTORS

Collector is the "furnace" of a sun warming scheme is the part that is uncovered to the sun emission from the solar and conditions the procedure of bind sun power into dependable temperature cause for residence, trade and manufacturing. Of all the fundamentals in sun aided warming scheme, antenna is the mainly significant part [12]. Sun antennas may be classified into two common groups: (i)Tracking and (ii) Non-tracking. Major aim of the tracking kind is to present the shell straight towards the solar to get highest energy. An antenna parallel to the solar obtains no emission. As antennas are huge in amount and need complicated mechanisms, tracking type is rarely utilized. Fixed antennas are in common utilizing. The antennas as exposed are consist of a part of a spherical mirror located in a motionless location facing the daylight. It has a linear sucker that can track the picture of the daylight by a simple rotating movement about the center of curvature of the reflector [13].

III. WORKING

Surface light into electric power, is used. The electric power produced in this method is stored in electrical storage system (Rechargeable batteries). Such kind of storage setup contained of photovoltaic (PV) energy asset associated to a battery via an inverter, charge controller and inverting leads. PV acid batteries are called good kind of batteries having low up from price and more availability. The Selenium is a good photoconductor and Photovoltaics are made . Daryl Chapin made a sun cell made of silicon in 1954 [14]. In 1958, PV's were used successfully as an energy way for the satellite. This prototype was followed by many others, so that by the late 1960s PV had become the made source of power for satellites. It played an essential part in the success of early profitable satellites [15].

Microscopic study of SPVC tells us that SPVC have life period of 30-35 years and dry batteries have life 10-15 years.

IV. EXPERIMENTAL TECHNIQUES AND DISCUSSION

The experimental technique that is used in this research is very simple. The solar panels have been used in parallel with a storage battery normally rated at 12 volts be efficiency of system is quite stable and reliable. So this system can be used to power any conventional electrical application. Hence, the 76 watts solar energy saver has been providing light during those load-shedding hours. In this way goal of research project has been achieved. All these panels are mounted on a MS stand. The measurement of Solar Electric Power in the form of A.C, D.C. volt, current and Power efficiency of the system by using inverter (regulated voltage) when solar panels are connected in parallel combination at different temperature with time of the day. The results of solar cells connected in parallel show that only short circuit current and maximum power output is added up. This is because the current is added in parallel circuits and voltage remains constant. The changes in fall factors and efficiencies are only because of changes in solar intensities i.e. by connecting the solar cell modules in parallel, efficiency is not added up.

The readings for solar panels connected in parallel were taken at different temperature of the day. The month-wise readings taken at UIT RGPV BHOPAL have been tabulated in tables 1-3.Individual solar cell gives 0.5A closed circuit current and 17V in normal conditions. So the resulted output power will be 74watts. The graphs show that efficiency of solar cell increases with increasing solar intensity. And also indicates that short circuit current increases by increasing the solar intensity. The graphs are not linear because the readings were taken in natural environment where it is not possible to make solar intensity and temperature constant that is supposed in this experiment. In the light of above discussion and on the bases of results obtained and observations found.

Moreover there are number of Applications in which solar energy can be used as basic power for their operation throughout the world. Our study about temperature data collected in 3 months and graphs plotted between efficiency and days are shown that if the temperature increases, efficiency of the signification crystal decreases and if the temperature decreases, efficiency of the crystal increases.

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Month Wise Readings Taken at UTD RGPV BHOPAL

Table No. 1

Date	Time	Room Temp T1	Outside Temp T2	Efficiency ETA%
9-MAY	8am	35c°	38c°	46.3
10- MAY	9am	36c°	37c°	51.4
	8:49am	34c°	35c°	
	11:40 AM	35c°	39c°	48.1
12- MAY	1:20pm	35c°	40c°	
	8:30am	34c°	29c°	
	11:32am	32c°	30c°	45.8
13- MAY	4:00pm	34c°	35c°	
	8:50am	31c°	34c°	
	12:15pm	32c°	37c°	
	1:45pm	32c°	39c°	43.8
14- MAY	4:00pm	31c°	38c°	
	6:45am	30c°	32c°	
15- MAY	4:00pm	35c°	39c°	43.8
	8:35am	30c°	32c°	
16- MAY	1:05pm	31c°	39c°	44.5
	9:30am	32c°	39c°	
	12:00pm	34c°	40c°	45.1
17- MAY	2:00pm	33c°	40c°	
	8:30am	34c°	33c°	
	12:20pm	35c°	40c°	48.0
19- MAY	12:09pm	36c°	40c°	
	8:30am,	33c°	31c°	
	12:05pm	36c°,	40c°	44.1
20- MAY	12:50pm	34c°	39c°	
	8:30am	33c°	37c°	
21- MAY	12:00pm	34c°	39c°	51.5
22- MAY	6:30am	32c°	34c°	46.8

23- MAY	8:00am	31c°	29c°	53.3
	12:15pm	33c°	38c°	
	2:15pm	32c°	36c°	
	3:46pm	35c°	37c°	
24-MAY	8:15am	34c°	32c°	54.4
	1:28pm	34c°	37c°	
26-MAY	8:20am	35c°	38c°	57.5
	12:00pm	35c°	41c°	
27-MAY	8:30am	34c°	29c°	49.2
	12:00pm	33c°	37c°	
28-MAY	8:15am	33c°	32c°	47.2
	12:00pm	34c°	40c°	
29- MAY	12:00pm	34c°	40c°	54.7
30-MAY	8:15am	32c°	29c°	55.9
	12:00pm	31c°	30c°	
31-MAY	8:10am	32c°	30c°	53.0
	12:10pm	33c°	38c°	

Graph No. 1: Month of MAY

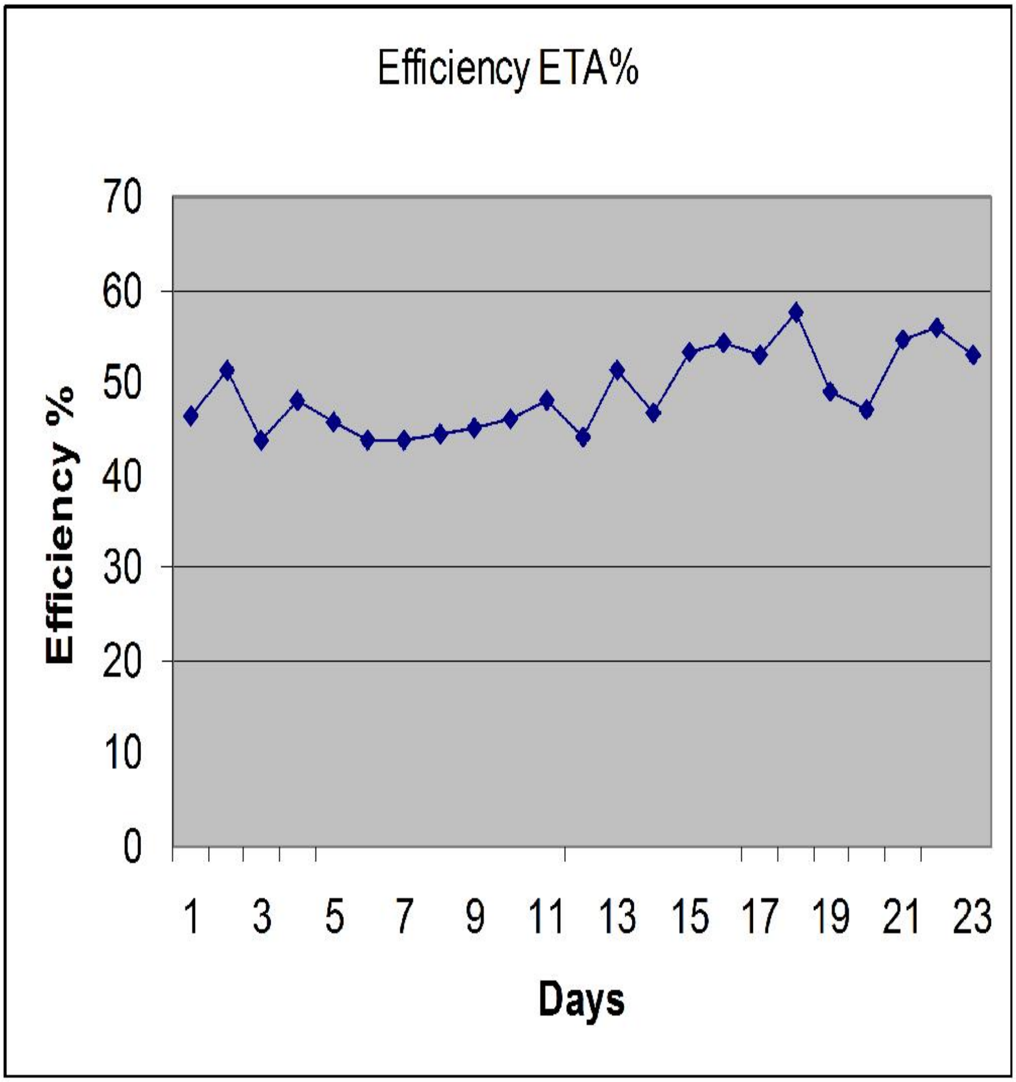

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Table No. 2

Month of APRIL 2014

Date	Time	Room Tem C	Outside Temp	Efficiency ETA%
1-APRIL	8:30am	31c°	30c°	55.4
	1:15pm	33c°	39c°	
	2:15pm	33c°	40c°	
2- APRIL	8:05am	34c	39c°	51.0
	12:00pm	33c°	39c°	
3- APRIL	8:15am	32c°	37c°	48.5
7- APRIL	8:00am, 12:00pm	32c°	26c°	52.0
		31c°	32c°	53.9
		32c°	41c°	
8- APRIL	8:30am, 12:00pm	33c°	35c°	55.4
		34c°	40c°	
9- APRIL	8:15am, 12:00pm	33c°	32c°	51.6
		34c°	38c°	
10- APRIL	8:15am	34c°	39c°	50.7
11- APRIL	8:20am, 1:05pm	35c°	39c°	45.7
		36c°	41c°	
15- APRIL	8:30am	33c°	32c°	55.5
	1:50pm	33c°	40c°	
16- APRIL	8:30am	32c	35c°	44.1
	12:45pm	34c°	40c°	
17- APRIL	8:15am	33c°	32c°	53.4
	12:00pm	34c°	40c°	
18- APRIL	8:20am	34c°	35c°	51.8
	1:00pm	34c°	40c°	

	11:35pm	34c°	35c°	57.6
	2:00pm	33c°	38c°	
	9:58am	34c°	37c°	56.3
21- APRIL	2:20pm	34c°	39c°	
	8:15am	34c°	35c°	52.6
22- APRIL	1:00pm	34c°	39c°	
	8:30am	33c°	34c°	42.6
	11:54am	34c°	38c°	
	2:56pm	35c°	36c°	
23- APRIL	6:15pm	34c°	33c°	
	8:15am	34c°	35c°	49.1
24- APRIL	11:55am	34c°	39c°	
	8:15am	34c°	36c°	51.4
25- APRIL	12:00pm	35c°	39c°	
28- APRIL	8:30am	32c°	33c°	58.7
29- APRIL	8:30am	31c°	33c°	60.3
30- APRIL	9:00am	32c°	33c°	58.8

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GRAPH NO. 2: MONTH OF APRIL

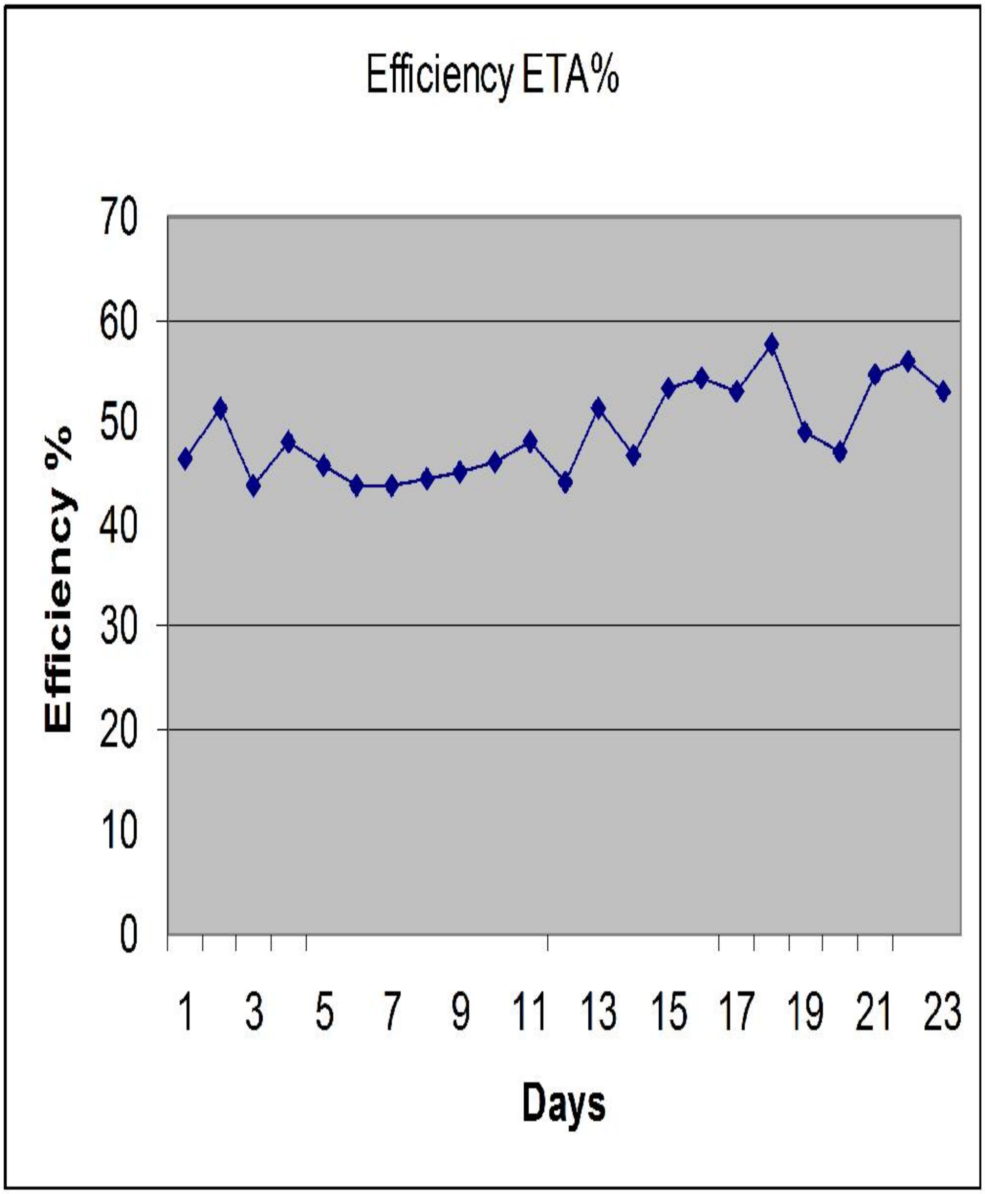


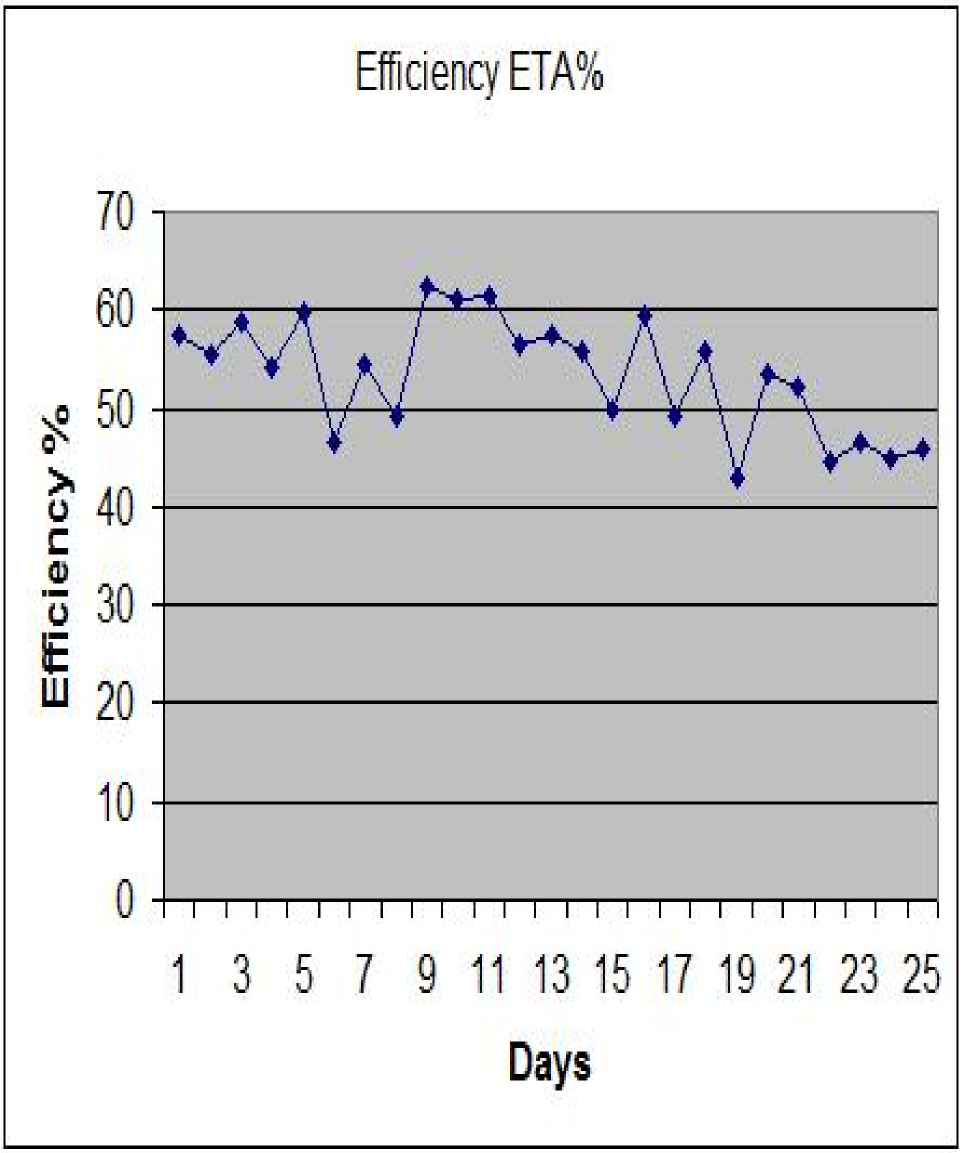
Table No. 3

Month of MARCH 2014

Date	Time	Room Temp	Out side Temp	Efficiency ETA%
1-MARCH	8:39am	31c°	28c°	57.3
	2:12pm	34c°	40c°	
3- MARCH	8:50am	31c°	28c°	55.5
	12:00pm	31c°	36c°	
	3:33pm	31c°	40c°	
4- MARCH	8:35am	31c°	30c°	58.8
	2:23pm	32c°	38c°	
5- MARCH	8:30am	32c°	30c°	54.0
	2:51pm	31c°	30c°	
6- MARCH	3:15pm	30c°	27c°	59.6
	2:06pm	30c°	29c°	
7- MARCH	8:45am	30c°	29c°	46.6
	12:50pm	30c°	39c°	
8- MARCH	8:00am	30c°	31c°	54.5
10- MARCH	7:45am	31c°	29c°	49.3
	12:00pm	32c°	39c°	
11- MARCH	8:05am	29c°	25c°	62.3
				61.1

12- MARCH	8:45am	30c°	32c°	
	9:34am	30c°		61.4
13- MARCH	2:20pm	32c°	34c°,38	
14- MARCH	8:00am	30c°	32c°	56.6
15- MARCH	8:00am	31c°	31c°	57.3
17- MARCH	7:55am	32c°	30c°	55.9
18- MARCH	8:00am	31c°	30c°	49.7
20- MARCH	8:00am	32c°	31c°	49.2
21- MARCH	11:38am	31c°	39c°	55.8
22- MARCH	7:50am	29c°	25c°	42.9
24- MARCH	8:00am	29c°	30c°	53.6
25- MARCH	7:55am	29c°	30c°	52.3
26- MARCH	10:38am	30c°	36c°	
	8:10am	30c°		46.6
27- MARCH	11:25am	30c°	27c°	
28- MARCH	8:00am	28c°	25c°	45.0
29- MARCH	8:07am	29c°	26c°	45.8

Graph No. 3: Month of MARCH



V. CONCLUSION

From our study of collection data it is clear that the conversion efficiency of the system in use is about 40%.The efficiency of PV panel use is, according to the manufacturer specifications, is 40%.This makes the conversion efficiency to about 5.5%.Such a figure may not appear attractive under present day circumstances. However, it is only a matter of time that even this figure will appear significant. Most important part of this study is that it shows that this vast amount of power is readily available without the use of any unconventional, controversial or advance technique. Our study of solar power conversion clearly establishes that it is the only viable, economical and practical method of power generation for the future generations of India.

Our study will certainly attract attention of public sector power generation entities, nevertheless, because of its short set up and in future short pay-back time will also attract many private sector organizations, especially, the house developers. With the application of study, even the owners of arid land shall be able to earn a reasonable income leasing their land to solar generation companies. Part of the solar electric power generated may also be used for lighting, water from the well in area like Bhopal. This may not only give a boost to the well being of the resident but also improve the agriculture of these areas. It is proposed that electric solar energy power obtained by a vast array of solar cells will be converted in to the high voltage alternative current which will then be exported to Europe through sub marine cables in Mediterranean sea.

It is estimated that only a portion of the Sahara Desert will enough to provide power to whole of Europe throughout the year. Present load shedding in urban areas has recently given birth to the UPS technology in India. A very large middle to high class homes and small to medium business establishment have started relying upon this system (uninterrupted power supply). The UPS system comes half way between the systems used by the Author. If only an appropriate number of PV arrays and a control regulation system is incorporated in present day UPS system, it will be able to take up 50% of the total electrical load of small home or 25% of the total electrical load of small business establishment.

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