DCT's
Dhempe College of Arts and Science
Miramar, Goa

- **Report on Solar Energy Utilization Development Project**

The renewable energy holds the key to the future of energy, food and economic security. All efforts are directed for alternate source of energy such as wind, solar, hydro etc. Renewable energy sources are broadly classified as solar and terrestrial. Solar energy has tremendous potential for meeting a significant part of human electricity needs.

Solar energy is radiant light and heat from the sun is harnessed using a range of ever-evolving technologies such as solar heating, solar thermal energy etc. The earth receives 174 petawatts of incoming solar radiation at the upper atmosphereapproximately 30% is reflected to the space while the rest is absorbed by clouds, oceans and land masses. The amount of solar energy that reaches the earth's soil is so huge which is about ten thousand times greater than all the energy used by humanity.

Solar energy is converted into electricity using solar or photovoltaic cell. A solar cell is an electrical device that converts light energy into electrical energy by the photoelectric effect. Solar cells work on the principle of photoelectric effect. In photoelectric effect the photons strike the element surface, and the energy of the photons is transferred to the electrons present in the valence band of the element. This energy is sufficient to excite the electrons from the valence band to conduction band, thus giving rise to free electrons. These free electrons form the base for the electric current in the circuit.

The solar cell comprises of two layers of oppositely charged semiconductor material, usually silicon joined together by wire. In solar cells the absorption of photons which results in the generation of the charge carriers and the subsequent separation of the photogenerated charge carriers take place in semiconductor material. Therefore, the semiconductor layers are the most important parts of solar cell.

Sunlight is made of photons, when sunlight strikes the solar cell these photons are absorbed and sent through the semiconductor material of the solar cell, which knocks the free electrons from the atoms in the semiconductor material, this develops electric field across the layers causing electricity to flow.

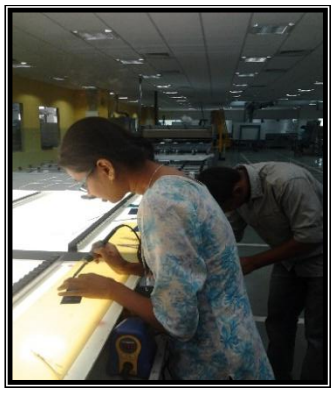
Knowing the importance of solar energy, a "Two Day Non-Conventional Course" on "Solar Energy Utilization" was conducted by department of Physics in association with Goa Energy Development Agency (GEDA) on 7^{th} and 8^{th} March 2013 for students and staff members of Dhempe College. All together 25 participants took the benefit of the course.

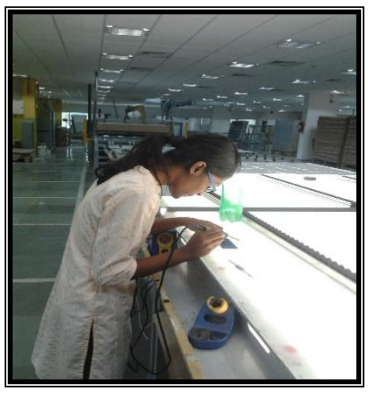
On 7th March 2013, GEDA exhibited and demonstrated the solar energy utilization kits like solar cooker, water heater, solar lantern, streetlights, water purifier etc. through their movable vehicle to the participants. This was followed by a talk on "Energy saving in day-to-day life" which was given by Ms. Anupama Khorjuvakar, Engineer from GEDA. Second talk was delivered by Dr. Pramod Pathak, Member Secretary,GEDA on "Uses of Solar energy and Science Behind it".

The participants were taken on the terrace of Dhempe College and Dr. Pathak demonstrated how the germs in the water can be destroyed by using solar energy for different containers of different materials. He also showed charging of solar lantern. This session was followed by a talk and demonstration by Mr. Gaurish Kauthankar, Engineer from GEDA on technology used in conversion of solar energy into electrical energy. Next session was conducted by Mr. Kalidas Shet from GEDA on successful implementation of technology used in solar lanterns in rural areas.

As an outcome of two-day workshop, three T.Y.B.Sc. students of Physics Department Ms. Moumita Baruai, Ms. Swati Madkaikar, Mr. Joquim Da'costa from T.Y.B.Sc. under guidance of Dr. Miskil Naik undertook a project on "To study the construction and working of solar cell panel and solar charge controller"for the academic year 2014-15. In this project a solar panel was fabricated by student with the help of "Agarwal Renewable energy company".

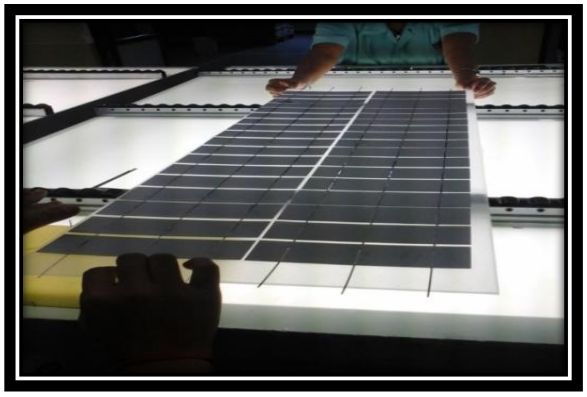
For the fabrication of solar panel several photovoltaic cells were needed. These photovoltaic cells were assembled to create a solar module. The minimum power required for working of streetlight is 35 W, so solar panel of 35 W was fabricated. The size of the glass plate used as the base of the panel is 980mmx335mm. as each cell gives 3W power to get 35 W,the number of cells required to make panel was 12 of size 156mm x156mm. Keeping this in mind the size of the glass available and outer lookof the panel each cell was cut into three cells of size 156mmX52mm each making a total of 36 solar cells. The cells were tabbed with interconnection wires called tab wires of 90mm in length to each connection strip in the front of each solar cell. Which were then arranged in series in two rows of each cell comprising of 18 cells in each row and by keeping 5mm space in betweenand were soldered using flux. Then ethylene vinyl acetate (EVA) sheet which is a protective thermoplastic called as UV resistant Surlyn sheet was placed on top of the glass plate and the connected solar cells were placed in two rows. The two rows were connected in series using bus bar wires.Once the assembly was ready, tedlar sheet was placed on top of the solar cells. The panel was laminated at 140^0C in a lamination machine. During lamination the EVA sheet melts, and front side of the panel becomes transparent.





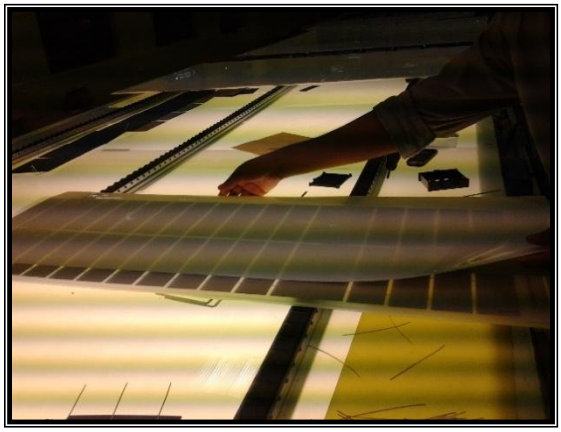
Tabbing of solar cells with interconnecting wires


Putting solar cells in two rows

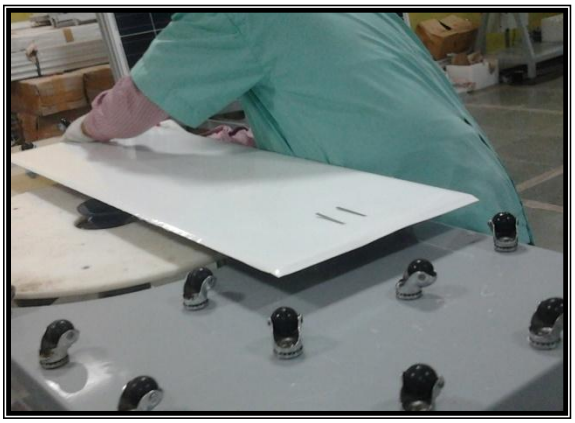


Connected Solar cells placed face-down on EVA sheet

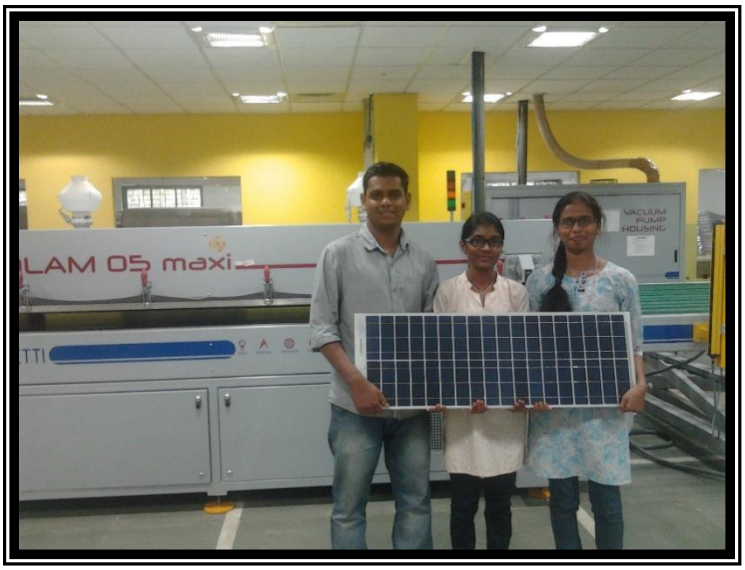
Connecting the tab wires of positive and negative terminal



Tedlar sheet is being placed on the solar cells



Lamination of panel



Solar Panel ready to use

A charge controller was also constructed. The charge controller limits the rate at which electric current is added to or drawn from electric batteries it also prevents overcharging and acts as a safety.The solar charge controller controls the battery charging from solar cell and also controls the battery drain by load.Finally the panel was mounted on college terrace and the street light installed at the security wall .The assembly includes a 17AH battery for back up and 9W LED dc light as a output. The unit when assembled it is found that the solar light could work for maximum 10hrs in the night. For 35w solar panel an output current of 2.1 Ampcan be obtained and a 9W LED consumes 1amp/hr.

In this project solar panel was constructed and used to light one streetlight. The same panel could be used for lighting more LED's bulbs. This could be done by changing the panel module from 35W to 50W and battery from 17Ah to 35-40 amp. The Solar panel module to 50W and battery to 40 amp.

In continuation with Solar energy utilization project college procured two solar panels of 75 Watts each in the year 2015-16. Energy generated is utilized in lighting 6 streetlights of 9W, which are being fixed around the campus of college.

In 2016-17 college fixed 3 LED bulbs in the Physics Staff room which drew energy from 35 W panel which was fabricated by students.

As Goa Government promotes generation and use of clean and green power by harnessing renewable forms of energy. It also promotes private sectors participation in the development of solar PV power and other renewable forms of energy Government has also constituted bodies likeGoa Energy Development Agency which focuses on promotion of solar, thermal, and hybrid-based energy efficient devises. To fulfill these needs Goa government is encouraging people, education institutes, industries to use solar based applications to generate electricity so that the money which they are paying to neighboring states can be utilized in for other development in the state. To support this state mission during academic year 2017-18 Dr. Swati

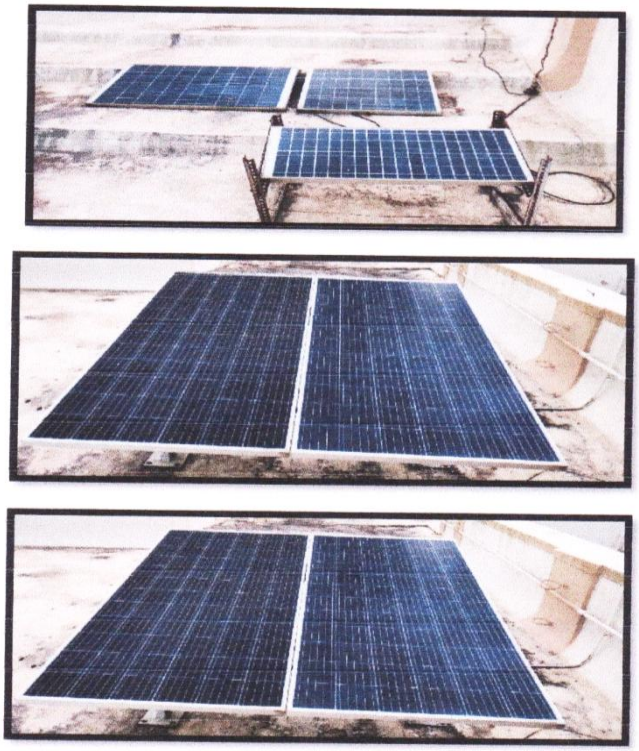
Pawar and Dr. Miskil Naik faculty from Physics Department Dhempe College undertook a three-year project of

5 lakhs sanctioned by Directorate of Science & Technology titled" **Design and development of a photovoltaic and human power hybrid energy system for varied applications"** In the present work it is planned to fabricate the hybrid energy system in the student gymnasium. The idea would be to convert any existing peddling system to an energy generator unit through associating a dynamo generator. The DC electrical output would be clubbed with the Photovoltaic output and then fed to the battery storage system.

As one of the requirement for completion of this project following items for Solar PV installation in the month of January 2020 were procured.

1. Solar panels two in number of 330Watts
2. Inverter 1KVA
3. Batteries two in number of 100Ah

With the above configuration the output generated is connected to the corridor LED tube lights (16 in number). These tube lights runs in the night around 7-8 hours



Solar Panels on the college roof top

(Dr. Swati Pawar)