A TECHNICAL REPORT ON STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME (SIWES)

HELD AT:

EMSA-TECH SOLAR & ELECTRICAL COMPANY,

TANIMOLA STREET OFF ABAYOMI IWO ROAD,

IBADAN OYO STATE.

BY:

ADEFILA OLUWASEGUN EMMANUEL

MATRIC NO: ND/23/EEE/PT/0196

SUBMITTED TO DEPARTMENT OF ELECTRICAL/ELECTRONIC ENGINEERING. INSTITUTE OF TECHNOLOGY (I.O.T).
KWARA STATE POLYTECHNIC, ILORIN
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DEDICATION

This work is dedicated to the Almighty Allah, the giver of all things who gave me the opportunity to undergone this three months industrial training SIWES programme, it is also dedicated to my parent: **Mr. & Mrs ADEFILA.**

ACKNOWLEDGEMENT

All praises, honour and glory to Almighty Allah for his abundance blessing and proper protection over me with his support during SIWES and completed successfully. The giver of all knowledge for giving me the privileged and opportunity to finally put together these texts. I gratefully acknowledge the staffs of **EMSA-TECH, TANIMOLA STREET OFF ABAYOMI IWO ROAD, IBADAN.** for the role played during my SIWES program and the knowledge which I gained during my SIWES programme with them. I also acknowledge the effort of my parents; **Mr. and Mrs ADEFILA.**

PREFACE

This is a report of 16 weeks Industrial Training which was done as a part of the requirement needed for the award of national diploma certificate which was embarked upon by the technical student after first year stay in school.

It is also done to enable the student exposed to the practical aspect of this course of study and write down what he/she has gained during the traning.

The programmes is aimed at correcting the incompetence in the school leaving scientific and technical in the country.

ABSTRACT

This technical paper describes solar energy and Its Maintenance. Solar Energy is refers to as the energy from the sun; the conversion of the sunlight into electricity gives you Solar power. It allows any user with necessary receiving components to receive the sun for its utilization by using photovoltaic (PV). Photovoltaic convert light into an electric current and this current can be converted into alternating current (AC) using an inverter and also stored using well arranged batteries for use in homes for illumination and for appliances at home. This technical paper will discuss in details the necessary steps to be taken for proper installation and maintenance of solar energy.

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CHAPTER ONE

1.0 INTRODUCTION

Student industrial work experience scheme (SIWES) programmed, it was establish in year 1973 by Federal Government of Nigeria through the Industrial Training Fund (ITF) under the NTBE (National Board for Technical Examination). It has it's headquarter in Jos, Plateau State. The major reason behind the establishment of SIWES programmed and the importance of the student to display their talents and also learn the practical aspects of their fields of study. After their graduation, they will have something valuable to contribute to the society. They will also be able to face future challenges in their respective field of study.

1.1 SPECIFIC AIMS OF SIWES.

a) To introduce trainee to the industrial atmosphere and discipline.
b) To provide opportunity for the trainee student to apply knowledge obtained in form of lecture and practical to industrial reality.
c) To provide an opportunity for the trainee student to assess their own suitability for carriers.
d) It enable the industrial to be able to recruit graduates to the post appropriate to their background, training and the orientation during the change over from student to work status.
e) To be introduced to as wide a range of industrial skills as much as possible.
f) To enable trainee student become familiar with the organization and control of the industries similar to where they are likely to work after graduation.

1.2 OBJECTIVES

Specifically, the objectives of the students industrial Work Experience Scheme are to provide an avenue for students in Nigeria Tertiary Institutions to acquire industrial skills and experience in their course of study.

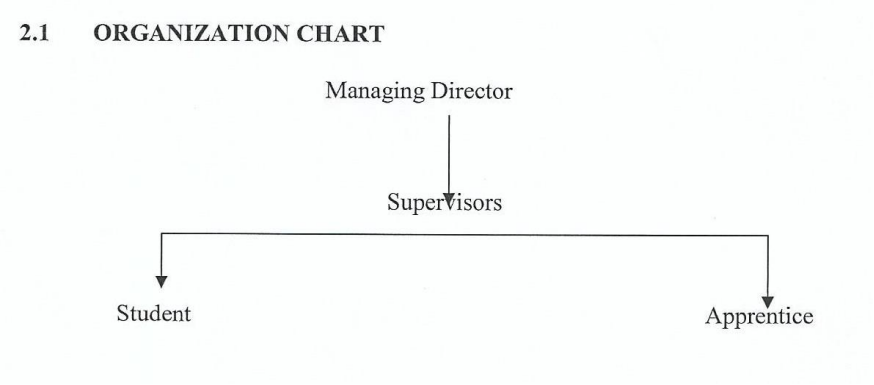
CHAPTER TWO

2.0 BRIEF HISTORY OF THE ORGANIZATION

EMSA-TECH SOLAR & ELECTRICAL COMPANY was established in year 2006.

The Chairman of the company has experience in SOLAR INSTALLATION especially in house and company he has works in many companies.

2.1 ORGANIZATION CHART



CHAPTER THREE

3.0 INTRODUCTION

Solar energy in recent years has attracted more attention to people due to inefficiency and unavailability of power for different use in homes and industries. It is a well known fact that the world is facing a major threat of fast exhaustion of the fossil fuel reserves like in Nigeria where our source of energy is from natural gas and water [1] . There has been general outcry against lack of constant power supply to help our industries and home appliances. This has brought about the urgent need to explore other means of power generation such as solar energy. Research has been into the development of reliable and strong systems to harness energy from nonconventional energy resources. Solar power source have experienced a tremendous rapid growth in the past ten years and is Pollution free source of abundant power. This paper lists the basic components needed for installation of solar energy at homes; this includes the solar panels (PV modules), Charge controller, Battery, Inverter, Connecting wires in today's climate of growing energy needs and increasing environmental concern alternatives to the use of non renewable and polluting fossil fuels have to be investigated, one such alternatives energy I solar energy.

Solar energy is quite simply the energy produced by the sun and collected elsewhere, normally the earth. The sun creates its energy through a thermonuclear process that convert about 650,000,000 tons of hydrogen to helium every second. The process creates heat and electromagnetic radiation. The heat remains In the sun and is instrumental in maintaining the thermonuclear reaction. The electromagnetic radiation (including visible light, infrared light an ultra violet radiation (including visible lights, infrared light an ultra violet radiation) streams out into space in all direction.

Only a very small fraction of the total radiation reaches the earth. The radiation that dies reach the earth is the indirect source of nearly every type of energy used today. The exceptions are geothermal energy, and nuclear fission and fusion. Even fossil fuels owe their origins to the sun, they were once living plants and animals whose life was dependent on the sun.

Much of the world required energy can be supplied directly by solar power, more can still be provided indirectly. The practicality of doing so will be examined as well as their benefits and drawbacks. In addition the uses solar energy is currently applied to will be processed. Due to the

nature of solar energy, two components are required to have a functional solar energy generator. These components are:

1. Collector
2. Storage unit

The collector simply collects the radiation from the sun and converts a fraction of it to other forms of energy (either electricity and heat or heat alone). The storage unit is required because of the non-constant nature of solar energy, at certain times only a very small amount of radiation will be received, a night or during heavy cloud-cover, for example, the amount of energy produced by the collector will be quite small, the storage unit can holds the excess energy produced during the periods of maximum productivity, and release it when the productivity drops.

3.1 COMPONENTS OF A SOLAR POWER

Solar design and installation is absolute easy thing one can do but with proper knowledge, training and skill with some money to purchase the equipments. Some of the components you need for installation of solar energy are listed below:

- Solar system
- Solar panels (photovoltaic PV modules)Charge controller
- Battery
- Inverter
- Connecting wires
- Appliances (like Bulb, TV, Fan etc)

1) **The Solar system**

Solar System can be defined as the Sun and everything that orbits the Sun which also include the planets and their satellites. It can also be called a group of celestial bodies orbiting another star. In this paper, solar system refers to the system that includes Earth and the Sun. Solar energy is the energy from the sun. It comes to us in form of light and heat. Nigeria receives about 4.851 X 10 12*P* KWh of energy from sun daily, 1.804 X 10*P* 15 *P*KWh annually and the country has average solar*P* *P*insolation of about 5.535KWh/m*P*2 *P*/day which will effectively be

used for solar power installation, and will bring about total change in power system failure in the country.

2) Solar panels (photovoltaic PV modules)

A solar cell or photovoltaic cell can be defined as a device that converts light directly into electricity by the photovoltaic effect. Solar Photovoltaic systems generate electricity directly using sunlight. Solar thermal systems actively or passively collect, transport, and utilize solar energy to generate heat. The generation of voltage across the p-n junction in a semiconductor due to the absorption of light radiation is called photovoltaic effect. The Devices based on this effect is called photovoltaic device.

The solar panel converts the solar energy (energy from the sun) to electricity which charges the battery. For more effective use, more than one solar panel are electrically connected to form array for the purpose of collecting a good amount of sun to charge the battery which will be capable of supplying a home the amount of electricity needed. Solar panel connections are done in two different ways for efficient useful work.

3.2 THE TWO WAYS OF CONNECTING SOLAR PV ARE AS FOLLOWS:

- Series connections.
- Parallel connections.

2.1) Series connection

Series connection simply is connecting solar panel positive terminals to negative terminals of another. It gives output voltage equals the sum total of the voltage of the entire module in the string and the output current equals the equivalent of the current for a single solar. In series connection all the currents are equal while the voltages are the sum of individual voltages.

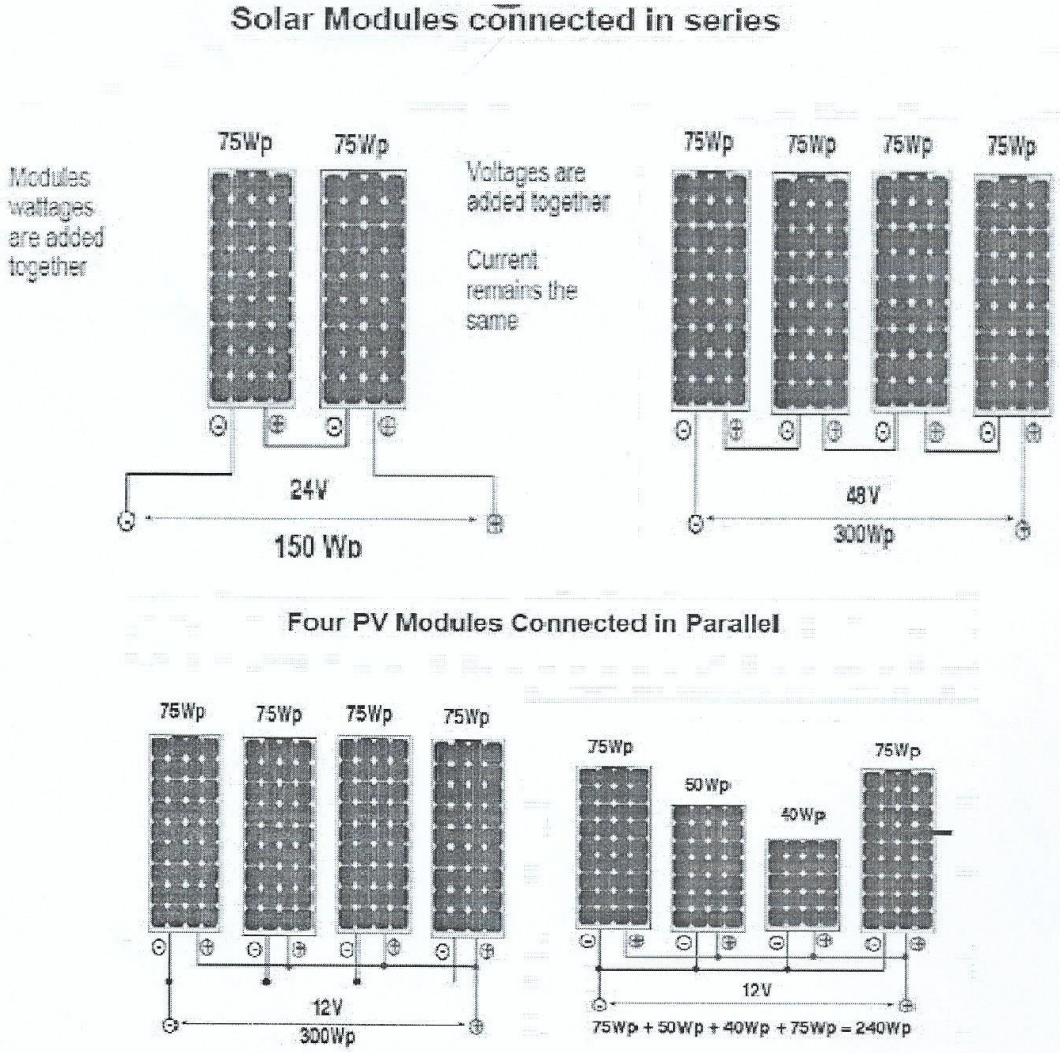


Fig 1b: Parallel connection of solar module

3.3 SERIES CONNECTION OF SOLAR MODULE

By Series connecting, the voltage equals the sum of those panels, being in series, the amperage is equal.

3.3.1 Parallel connection

Parallel connection simply is connecting the solar panel positive terminals to positive terminals of next and negative terminals to negative terminals of next. When using this type of connection, your voltage remains the same but your amperage is the total sum of the panels being used. That is to say, it gives output voltage equals the equivalent voltage of a single solar panel in the string and the output current equals the sum total of all the current of the solar panel in the string.

By parallel connected solar panel gives more current (amperage) the sum of individual currents, the voltage is equals.[4]

3.4 CHARGE CONTROLLER

Charge controller ensures is used to charge your batteries, it ensures that the battery is not over-charged or over-discharged; it stops receiving from the solar panel when the battery is fully charged and switches off every DC load connected to it when the battery is discharged to the minimum level.

These charge controllers regulate the charging of your batteries because they are programmed. The quality of these programs determines the lifespan of your batteries.

This is the reason only quality charge controllers should be used, because batteries are the most expensive part of any solar system installation. DC loads are taken directly from the charge controller. The procedure for selecting Charge controller is by determining the operating voltage of the PV array and the current, i.e. the charge controller must be sized to handle maximum current and voltage produced by the solar PV array.

3.5 BATTERY

Battery stores the electrical charge produced by the solar panel during the day. It helps the output of the solar panel when it cannot supply enough electricity to the system.

Batteries are a major cost of any solar system and are the most friable component in the solar system. Battery should have sufficient Amp hour storage to supply the needed power during the cloudy weather.

Batteries can be either shallow cycle discharge (for automobiles) or deep cycle discharge (for PV system).

A shallow-cycle batteries discharge only between 10% and 20% of their Ah capacity/day discharging beyond this point without recharging shortens the battery life.

Deep-cycle batteries are designed to allow a discharge of 60% to 80% of its Ah capacity.

A battery discharged at a rate of 1 amp will have a higher Ah capacity than a battery discharged at a rate of 4 amps. A battery which can deliver 1 amp for **100 hours has a capacity of** 100Ah @ **C100.** The same battery may only deliver 4 amps for **20 hours.** Then its capacity is 80Ah @ **C20. C100** means discharged over 100 hours, **C20** means discharged over 20 hours. Batteries are connected in series and parallel.[6]

3.6 INVERTER

This is what will turn the 12 volt DC current into 110-120 volts AC current for use in powering your household electrical devices.

An inverter is device that changes direct current (DC) from the battery to alternating current (AC) to be used for AC appliances.

The battery provides DC voltage to the inverter, and the inverter converts the DC voltage to normal AC voltage. The output of a solar PV system can be either DC or AC depending on the type of electrical load it is meant to power. If it is used to power a DC load, then there is no need for an inverter. However inverter is required when the electrical load is AC. One can choose to go for solar inverter; solar inverters have some special functions with the photovoltaic arrays like maximum power point tracking and anti-islanding protection. There are two types of inverters which include modified sine wave and pure sine wave inverters.

Note: the size of the inverter should be around three times what you plan to use it for, this is because the consumer products do not always use the best components and this is a way to ensure your unit will last longer than when you purchase an undervalued unit and push it to burn out.

Before you buy an inverter you need to take cognizes of the following:

i. The maximum load; the rating is larger than wattage of all the ac loads to be run at any one time
ii. The maximum surge; Inverter is designed to surge if motors will be connected.
iii. The output voltage
iv. The input battery voltage requirements

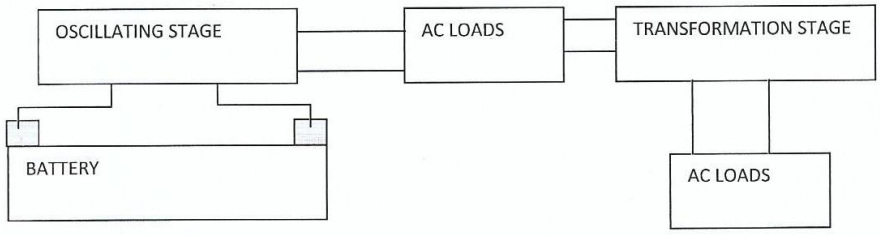
3.6.1 INVERTERS AND UPS

An inverter (UPS) is a power device that converts the battery power (DC current) into an alternating current (AC). Since home electrical appliances are not always designed to use the direct current from the sum, the inverter is introduced to convert the energy as explained. Above. UPS is simply (uninterrupted supply), which also does the same job as like an inverter. But for an inverter to work, it also needs another source of power bank (batteries).

There are three stages an inverter must undergo before the conversion process.

These stages include

- Oscillation stage
- Amplification stage
- Transformation stage



From the diagram above, it shows the process and stage by which an inverter goes through before it converts the DC current to AC for use in the home and other places using the same alternating currents.

Before an inverter starts inverting, it needs a power source (battery), this source enables the inverter to start working before any applied load, it also prepares the inverter for the solar panel that will be attached afterwards.

3.7 CONNECTING WIRES

They are used to connect one component to the other. The generated electricity (electric current) flows through them to the load. The recommended size of cables is 2.5mm.

3.8 THE STEP BY STEP INSTALLATION OF SOLAR ENERGY

Solar power plant installation is very easy. But before the actual work begins, the most important issues that you must have done are to know the total electricity consumption for the household, this can be done by taking a physical view of all the appliances to check their power ratings to know the capacity of all the system components and the total number of panels, batteries and the

capacity of charge controller and the appropriate inverter needed. Now the components are conveyed to the site a day before the actual installation. The stages in the installation include

1. Arrange the photovoltaic PV modules:

After bringing out the PV with the ratings behind the panel, the information you will see is the maximum wattage, voltage, and amperes. After that, wire the panel according to the required need but I prefer the parallel connection (the voltages remain the same while the currents is added). Then mount the PV on the rooftop of the building with a few inch gap and parallel to the surface of the roof. Solar PV can also be mounted on the ground. The solar array is usually best placed in perpendicular to the sun's rays, which change continuously over the course of the day and season. The most suitably location and inclination for a PV mounting is east front and slope of 30- 40*P*

2. Charge controller: The next thing to do after the setting up the solar PV array is to connect the charge controller (which you know is to ensure that the battery is not over-charged or over-discharged) directly from the output terminals of the solar PV using lighter gage wires. Note: DC loads can be directly connected to the charge controller. After the connection, we move to next step which is connecting the battery.

Battery: The batteries are properly connected either in series or parallel connection depending on your need, and then connect the battery to the charge controller at the port selected/indicated for it in solar charge controller. The next thing to connect is the inverter.

4. Inverter: The next setup is the inverter, as we discussed above the inverter converts the DC supply from the solar PV into the battery to AC supply in order to power our AC loads. Connect the battery terminal to the inverter with 2.5mm cable. Finally, from the inverter you connect to the external load in the house.

The rating of the inverter should be the same with rating of the PV array.

3.9 MAINTENANCE OF SOLAR PV SYSTEMS

Solar panels have no moving parts, and therefore no potential points of mechanical failure. Therefore properly installed PV system requires very little maintenance. After the installation of solar system for household use, best maintenance practice is to inspect the equipment especially batteries and modules, to make sure all electrical contacts are tight. We can keep the solar PV operational through two maintenance techniques which include the preventive and corrective

maintenance. Let us look at maintenance of the different components of the solar system which include:

1. Solar PV Maintenance

You should wash the PV array, during the cool of the day, when there is a noticeable buildup of dust and dirt. Periodically inspect the system to make sure all wirings and supports are intact. Furthermore, check for tree growth that has shaded your modules and also check for birds' nests in your modules and junction boxes. Review the output of the system annually (assuming the array is clean) to see if the performance of the system is close to the previous year's reading. Do not scratch the glass casing of the module.

2. Battery Maintenance

Battery is very important component in the solar system; therefore proper care should be taken. or long life, battery should be cleaned monthly; the electrolyte level should be checked and kept in a high state of charge. When cleaning batteries, beware of the battery acid and do not short the terminals. Carry the battery outside when cleaning to avoid spilling acid, keep plenty of water nearby to rinse spills.

3. Charge controller malfunction

Charge controller will be will go bad if the battery voltage exceeds the appropriate set voltage for the type of battery used, and also the batteries are bubbling severely causing a lot of moisture accumulation on the battery tops. Charge controller can go badly if the battery bank capacity is not up to the rate.

4) Some of the general precaution/maintenance to be carried on the system include:

- Observe the tightness of screws on all connector strips, controls; switches, etc. make sure that they are well chewed. This is mostly important for old or exposed wire.
- Look at the junction boxes to make sure that insects have not build house there, and also make sure they are watertight when exposed to the environment.
- Inspect switches to make sure they are in good operating manner
- Inspect the fuses to ensure no one is blown. If blown, find the cause and replace or repair with a new one of the same size.
- Inspect the indicator lamps on the charge controller. The solar charge controller indicator should be ON when the sun is up. If is not ON. Check to see if batteries are being charged. Check whether the other LED indicator lamps are working (that is battery full and low voltage).
- Check grounding wires to make sure they are still intact.

CHAPTER FOUR

4.0 RELEVANCE OF THE EXPERIENCE GAINED

In summary, this program has exposed me to some practical aspect in relation to my course of study (Electrical engineering) and I benefitted greatly from the grogram. What I learnt at various site involves the following.

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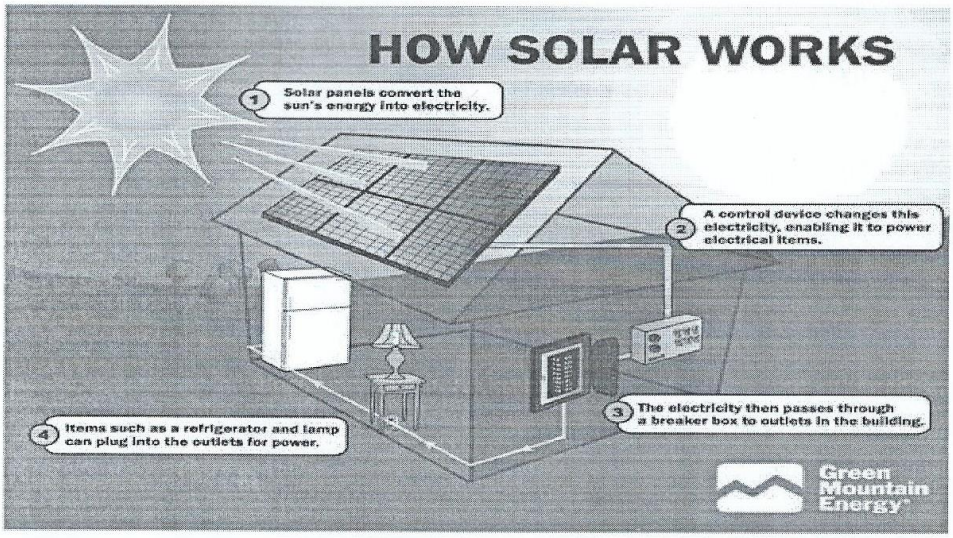
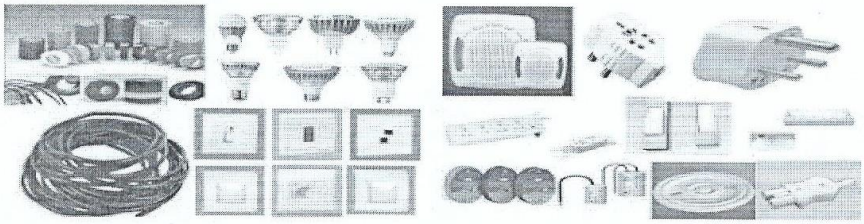
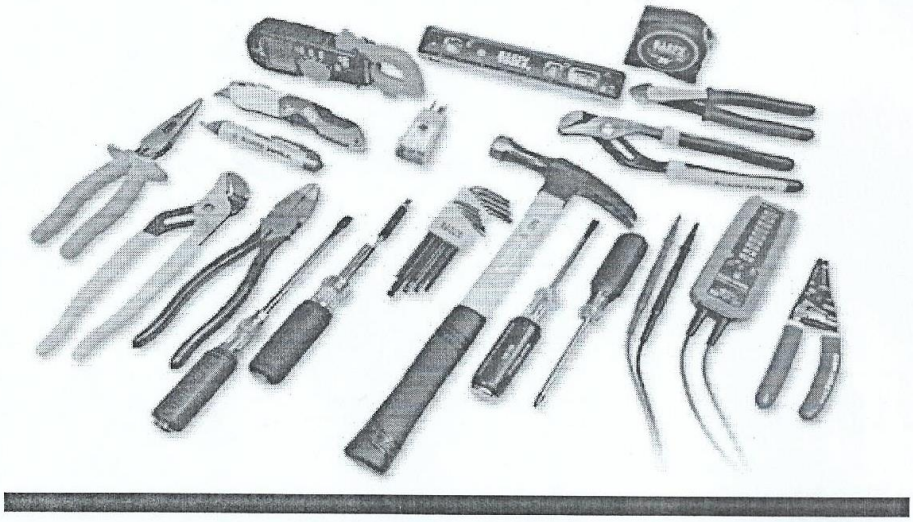
CHAPTER FIVE

5.1 CONCLUSION

In the present work a Solar PV Energy System was implemented. A portion of the energy requirement for a private house, farm house, a small company, an educational institution depending on the need at the site where used has been supplied with the electricity generated from the solar power. It reduces the dependence on one single source and has increased the reliability. Apparently, we can improve the efficiency of the system with an individual interest mode of generation. Photovoltaic systems are cost effective, pollution-free and maintenance free. They could be deployed in remote locations where conventional power is not readily available.







SOLAR DIAGRAM, ELECTRICAL TOOLS AND MATERIALS