A TECHNICAL REPORT ON

STUDENTS INDUSTRIAL WORK EXPERIENCE SHEME (SIWES)

UNDERTAKEN AT

PERFECT SEVEN GLOBAL CONCEPT LTD APAKE, OGBOMOSO,

OYO STATE, NIGERIA.

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SUBMITTED TO

THE DEPARTMENT OF ELECTRICAL ELECTRONIC ENGINEERING, INSTITUTE OF TECHNOLOGY (IOT), KWARA STATE POLYTECHNIC, ILORIN.

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DEDICATION

I dedicate this write up to Almighty God who made this program a success for me and my lovely parents for their support and words of encouragement rendered to me during my industrial training. Also, the entire staff of Perfect seven global concept LTD. for accepting me with arms wide open undoubtedly. May God bless and reward you all Amen.

ACKNOWLEDGEMENTS

It is always a pleasure to remember the good people in PERFECT SEVEN GLOBAL CONCEPT LTD , APAKE, OGBOMOSO, for their sincere guidance I received to uphold my practical as well as theoretical skills in ELECTRICAL AND ELECTRONICS ENGINEERING. I express my profound gratitude to my industrial based supervisor ENGR.MICHEAL OLOYEDE for his priceless training and fatherly counseling. I would like to acknowledge MR.TOSIN for his support and sincere guidance, and my colleagues for extending their kindness and friendship towards me and providing a pleasure-training environment.

Knowledge is power and unity is strength. Thank you all and God bless.

ABSTRACT

This report focuses on my Student Industrial Work Experience Scheme (S.I.W.E.S.). The S.I.W.E.S. program aims at improving the technical knowledge of students and to expose them to industrial works. My S.I.W.E.S. program was undertaken at PERFECT SEVEN GLOBAL CONCEPT LTD. The company majors in solar installation and designing electronics project. This program boosted my practical knowledge. Students should be allowed in the field for better understanding of the work they do in the office.

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CHAPTER ONE

INTRODUTION

1.1 STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME (SIWES)

The Student Industrial Work Experience Scheme (SIWES) programmed involves the student, the university and the industries. This training is funded by the Federal Government of Nigeria and jointly coordinated by the industrial training Fund (ITF). It's skill training program designed to expose and prepare students of Universities, Polytechnics, Colleges of Technology, Colleges of Education and Colleges of Agriculture for the industrial work situation they are likely to face after graduation. The scheme also affords students the opportunity to familiarize themselves with the needed experience in order to be able to handle some sophisticated devices and machineries that require technical knowledge which may not be available in their various institutions.

The rapid development and commendable achievements in the world of science and technology, since the past century till date has made the world in which we live in much more fulfilling and easier to live. The world script of advancement would have been incomplete without the impact of the field of surveying & geo-informatics.

The basis of surveying & geo-informatics is laid in the university, the knowledge which is both theoretical and practical; it gives a good foundation on which a student can build a successful career. The SIWES is of immense benefit in this regard because it provides the connection between our worlds of learning in the Nigeria universities to the amazing professional realities out there.

The importance of students from all institution of learning in every part of the world partaking in the industrial training scheme cannot be overemphasized i.e. Student industrial Work Experience Scheme (SIWES) otherwise known as industrial training (I.T) is a program

designed for acquisition of practical knowledge of science-based courses. The program forms part of the criteria for the award of Bachelor in Technology (B. Tech), among other degrees.

Students industrial working experience scheme (SIWES) was established in the year 1971, under no 47 decree and it is aimed at exposing students to the industry of their chosen field so as to get them trained, prepared and developed for technical and future operative skills, serving as an opportunity to increase the man power in the nation through practicing what has seen through theoretically in their various institution of learning, and Students' Industrial Work Experience Scheme (SIWES) was designed and jointly put in place by the Federal Government, Industrial Training Fund (ITF), tertiary institutions, and other agencies like National Universities Commission (NUC), National Polytechnics Commission, and National Board for Technical Education and National Council for Colleges of Education.

This purpose is laudable, it gives students the immense opportunity to experience the practical aspects of all that he has been taught for the past (31/2) three and half years. Through this exposure, students are expected to have better understanding of their profession and develop practical skill in addition to their acquired theoretical skills which they got from there institution. Students are exposed to some of the challenges in the industries and are supervised during their period of attachment to various organizations.

The six (6) month training is also an opportunity to have a taste of the business world in the students chosen field.

1.2 AIM AND OBJECTIVES OF SIWES

SIWES started in 1974 with the aim of making education more relevant and to bridge the young gap between the theory and practice of engineering, technology and science related discipline in tertiary institutions in Nigeria.

The objectives of the Students Industrial Work Experience Scheme are;

1. To provide students with industrial skills and needed experience while the course of study
2. To create conditions and circumstances, which can be as close as possible to the actual workflow.
3. To prepare specialists who will be ready for any working situations immediately after graduation.
4. To assist students to apply the clear vision and understanding gained during the program to the theoretical aspect of study.

CHAPTER TWO

2.1 COMPANY PROFILE

Perfect seven global concept LTD is a company majorly base on building project which include, Electrical installation, Solar installation and Mechanical Repair. Located in Apake area Ogbomoso, was established in the year 2008 by Engineer M. K. OLOYEDE, the CEO/managing director, with the motive of building an alternative power supply through the production of inverters and also the designing electronic projects.

2.2 PRODUCTS AND SERVICES

Perfect seven global concept ltd is a local based manufacturing industry which produces the following products:

- POWER INVERTERS: Inverter is a device that converts DC from a battery to AC power for use at homes, offices, industries etc. It serves as an alternative for the electricity from the grid. Faulty inverters are being repaired in the company.
- AUTOMATIC VOLTAGE REGULATOR: Automatic Voltage Regulator also known AVR or stabilizer are devices constructed to ensure voltage generated from power generator running smooth to maintain the stable voltage in specified limit. It can stabilize voltage value when suddenly change of load for power supply demand.
- CHARGE CONTROLLER: A charge controller also known as charge controller or battery regulator is a device which limits the rate at which electric current is added to a or drawn from electric batteries. It prevents overcharging and protect against overvoltage, which can reduce battery performance or life span. A series charge controller or series regulator disables further current flow into batteries when they are fully charged. Simple charge controllers stop charging a battery when they exceed a set high voltage level and re – enable charging when battery voltage drops back below that level. Charge controller can be further classified into PWM type and Maximum Power Point Tracker (MPPT), solar charge controller or electric charge controller
- AUTOMATIC CHANGE-OVER SWITCH: The Company also manufactures or produces Automatic change – over switch or Automatic Transfer switch (ATS) which is either an electrical, or electronic switches that switches load between two sources. Some transfer switches are manual while others are automatic. The automatic type

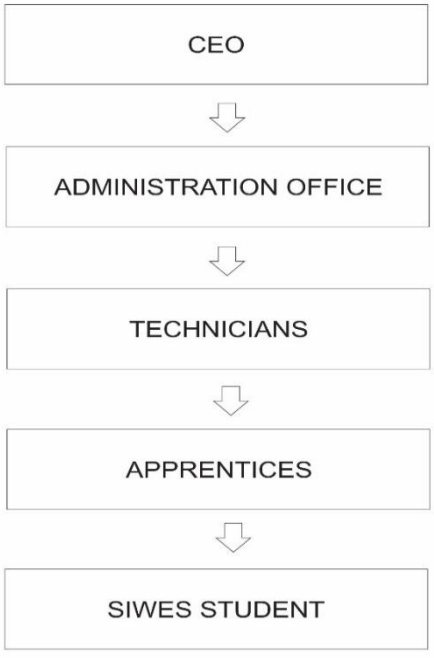
switch load between two sources. Some transfer switches are manual while others are automatic

- SALES OF ELECTRONICS COMPONENTS: We sell electronics components for electronics project, Solar panels, Circuit breakers, Solenoid, Integrated ICs (40 series and 70 series) and other assorted components and gadget
- TRAINING: The Company offers training for students, hobbyist and individuals who want to venture into Home automation system and control engineering. The following trainings are offered:

1. Basic Electronics Training
2. Power inverter and Power Solution Training
3. Electrical Installation
4. Solar installation

2.3 ORGANOGRAM OF THE COMPANY

The company organogram is shown below



ORGANOGRAM OF THE COMPANY

CHAPTER THREE

TOOLS AND DEVICES

3.1 COMMON TOOLS AND DEVICES USED IN COMPANY

These are the mechanical and electrical equipment necessary to execute task or make work easier, neater and faster. Examples of which are listed below.

1. Soldering iron: It can be used to join two components together and it can also be used in removing components on a board. For electronics the best is one powered by mains electricity. It should have a head proof cable for safety. The iron power rating should be 15 to 60w and it should be fitted with a small bit of 2 to 6mm in diameter.

Figure 1 Soldering Iron

2. Tester: It can be used to detect the presence of electricity in a material. It can also be used to drive a screw.
3. Screw Driver: It can be used to drive a screw in or out.
4. Spanner: It can be used to tit and loose a bolt depending of the size of the bolt

Figure 2 Spanner

5. Plier: The uses of Pliers depend on what you are working with. e.g. it can be used as a holding device that is in holding components. It can also be used to drive bolt depending on the size of the bolt and It can serve as a cutting device.
6. Cutting Plier: This is a type of Pliers used in cutting different components. e.g. wires, metals.
7. Multi-meters: It can be used to check the continuity of materials and it can also be used to test the effectiveness of different components like resistors, capacitors, diodes, transistors. etc. It can as well be used in reading the voltage and current present in a material when it is connected together. Multi-meter, are useful test instruments. By operating a multi-position switch on the meter, they can be quickly and easily set to be a voltmeter, an ammeter or an ohmmeter. They have several settings (called 'ranges') for each type of meter and the choice of AC or DC. Some multi-meters have additional features such as transistor testing ranges for measuring capacitance and frequency. We have two types of multi-meter which are digital and analogue, Analogue and digital multi-meters have either a rotatory selector or push button to select the appropriate function and range. Some digital multi-meters are auto ranging; they automatically select the correct range of voltage, resistance, or current when doing a test.

Figure 3 multimeter

1.

8. File: It can be used to remove the unwanted part from materials especially in metals and it can also be used in sharpen some tools.
9. Drilling Machine: It can be used in drilling holes and expanding holes. There are two kinds of these machine, we have the smaller size and the bigger size. The smaller ones

are used for drilling soft materials especially boards but the bigger ones are used in drilling metals.

10. Grinding Machine: It can be to remove components from a board or panel especially in the preparation of former used in transformer.
11. Hack Saw: It used in cutting different materials used in the workshop like heat sink, board, inverter casing. etc.
12. Computer Set: It is used in different ways depending on what we are to use it for in the workshop. It can be used in designing the circuit used for different operations (e.g. oscillator circuit, change over circuit, regulator circuit etc.)
13. Pressing Iron: It is used in transferring the circuit that is printed on the glossy paper to the board through the constant ironing process.
14. Glossy Paper: This is the best paper used for the transferred of a designed circuit to the board.
15. Copper Board: This is the one of the boards used in electronics work. After a particular circuit is design on a computer set and it is already printed on a glossy paper, the circuit is then transfer on the copper board so that when the board is etching the copper board will now become printed circuit board in which the board can now be used for what we specifically design it for.
16. Bread Board: This kind of board can just be used temporarily for testing of some circuit. Soldering operations is not of used.

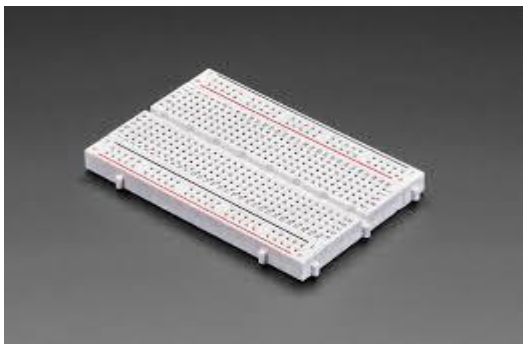


Figure 4 Vero board

17. Bolt and Nut: It is used in holding two things together.
18. Hammer: It is used especially in hammering process. For instant it can be used with chisel to cut anything in the workshop. It is also used when preparing a transformer to put the laminations in order.
19. Disordering Pump: It is a tool for removing solder when disordering a joint to correct a mistake or replace a component.

20. power meter: It is used to determine the strength of a battery.

Figure 5 power meter

3.2 COMMON ELECTRONICS COMPONENT USED

2. Step down Transformer: It is a device that steps down A.C voltage as a result of the coil windings. It comprises of the primary and secondary coil. The number of windings of the primary is more than that of secondary which is the reason for its low secondary voltage.
3. Diode: It is a device that allows current to flow in only one direction. It is composed of two terminals which are the anode and cathode. The cathode is recognized by a white stripe at its end. It is used to convert AC voltage to DC voltage.

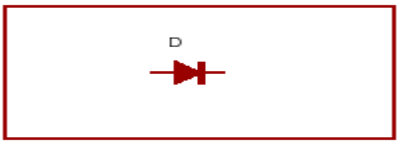


Figure 6 Diode symbol

4. Fuse: It is a device which breaks down when there is a sudden increase in input voltage. It serves to protect the entire circuit.
5. Capacitor: It has the ability to store charges and it also helps in smoothing the rectified D.C by removing ripples. It also helps in the R.C time constant function. The capacitance is measured in Farad (F)

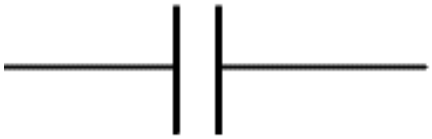


Figure 7 Capacitor symbol

6. Resistor: It a device that helps to limit current flow and its ability to limit current flow is known as resistance and is measured in ohms.

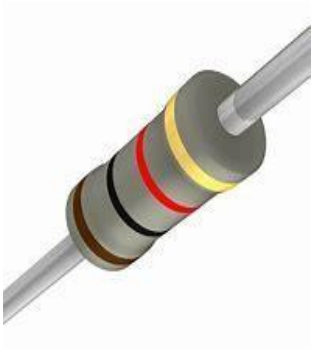


Figure 8 Resistor

7. Relay: This is an important component in the ACOS. It is a form of an electromagnetic switch composed of some wound coils and it works on the principle of SPST (Single Pole Single Throw) switch. Current applied to it terminals cause the contact to come together.

Figure 9 Relay

8. Operational-Amplifiers I.C: It is an Integrated circuit device that performs some arithmetic operation in the circuit. It serves to compare at its inputs voltage and sum it up to give an output.

Figure 10 Opamps IC

9. Transistor: A transistor is a semiconductor that serves a switch or amplifier. It comprises of three terminals; Base, collector and emitter. A small current applied at its base gives a much larger current flow from its collector to emitter.
10. Circuit Board: It is where the whole circuit is assembled. It is either a Vero-board, Dot-matrix board or a PCB (Printed circuit board).
11. Transformer; Transformer is a device that works by the principle of mutual induction it works on the alternating current {A.C} but cannot work on direct current {DC} signal this is because D.C do not generate mutual induction. And also, transformer is a frequent dependent electrical device which needs frequency generating source {A.C}. Transformers requires two coils wound on a laminated core which generally named to be primary and secondary coil, the former is connected to the A.C supply and the latter is from which the output is being tapped. It works on the principle of induction of electromotive force in the secondary coil and there will be transfer of electrical energy from one circuit to another without actual connection between primary and secondary coil. The useful formula is;

    $V1/V2 = N1/N2 = I1/I2$

    $N2/N1 = V2/V1$

    $N2 = 10,000/P$

    $P = 2(L+B)$

    VI = input voltage to primary coil

    V2 = output voltage from secondary coil

    N1 = number of turns in primary coils

    N2 = number of turns in secondary coil

I1 = current in primary coil

I2 = current in secondary coil

P = Perimeter

L = Length of lamination sheet

B = breath of the lamination sheet

Many are the processes, classifications and losses that occur in the transformation. The transformations that exist are voltage transformation from one level to the other level. The classification is in two ways, the first one is step down and step up while other classification is according to the uses i.e. voltage transformer, power transformer, isolation transformer and auto transformer. Also, their losses that exist during the transformer operation among which Eddy current, Hysteresis loss, cupper loss, flux leakage etc.

12. Voltage regulators: voltage regulators are ICs with three leads available with fixed (typically 5, 12, and 15V) or variable output voltages. They are also rated by maximum and minimum current they pass. Negative voltage regulators are available, mainly for use of dual supplies. Most regulators include some automatic protection from excessive current (‘overload protection’) and overheating (‘thermal protection’). Examples includes: 78XX series with positive output and the 79XX series with negative output. They include a hole for attaching a heat sink if necessary
13.

Figure 11 Regulator

CHAPTER FOUR

EXPERIENCE GAINED

4.1 SOLAR ENERGY

Solar energy is the energy (light or heat) that comes from the sun and subsequently converting it into electricity. We can then use the electricity to light up our homes, streets, businesses and power our machine as well.

There are two basic categories of solar energy:

i. **Solar thermal:** using the sun's energy to heat things like your house, water, food, etc.
ii. **Solar electric:** turning light from the sun directly into electricity, using solar panels.

4.2 SOLAR POWER SYSTEM

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

1. Solar panels (photovoltaic PV modules)
2. Charge controller
3. Battery
4. Inverter
5. connecting wires
6. Breaker
7. Solar racking system

4.2.1 THE SOLAR PANEL

This is the device that convert solar energy (sun-light) to electrical energy (in form of direct current D.C). The electrical energy being produced varies with the intensity of sun-light. The electricity is of 20V (average) and 300W.

TYPES OF SOLAR PANELS

Solar panels can be classified as:

i. Monocrystalline,
ii. Polycrystalline
iii. Amorphous (Thin film) solar panel.

These classifications are based on the silicon structure that comprises the cell. Basically, a 100 watts (W) monocrystalline solar panel should have the same output as a 100W amorphous panel and a 100W polycrystalline panel. The main difference is the amount of

Figure 3.1 Solar panel

space which the solar panel occupies. Because the monocrystalline structure is more efficient than amorphous in turning sunlight into electricity, the amorphous panel of the same wattage will be physically larger. Often amorphous panels are less expensive than the crystalline

panels but deteriorate a lot faster than crystalline panels.

4.2.2 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

Figure 3.2. Charge controller

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.

4.2.3 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 battery 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

Figure 12 Typical example of Battery

80Ah @ **C20. C100** means discharged over 100 hours, **C20** means discharged over 20 hours. Batteries are connected in series and parallel.

4.2.4 INVERTER

The inverter technology started with the high demand for power supply due to the improving society given the dwindling financial support from the government and other parastatals in the power sector along with the inadequacy and the un-sustainability of grants and subventions to find infrastructural improvement, mismanagement, vandalization of power installation, high cost of maintenance, inadequate gas supply, and so on. These problems have brought about the need for alternative forms of generating power supply such as wind mill, solar energy, inverters and UPS etc.

Inverters are used to create single or polyphase AC voltages from a DC supply. In the class of poly phase inverter, three phase inverters are the largest group.

CLASSIFICATION BASED ON OUTPUT WAVEFORM

There are three main different types of Inverter in use today based on the types of output waveform they supply. They are:

1. Square Wave Inverters
2. Modified Sine Wave Inverters
3. Pure Sine Wave Inverters

Square Wave Inverters

DC to AC conversion is most commonly done through use of MOSFET inverter circuits, which can switch the voltage across the load, providing a digital approximation of the desired AC signal. The simplest variant of this inversion is the production of a square wave approximation of a sine wave. For a square wave, the load voltage must be switched merely from high to low, without the need for an intermediate step (i.e. 0V). In order to deliver the

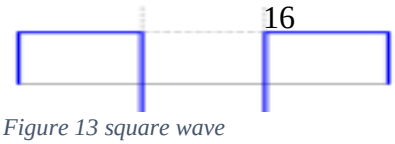


Figure 13 square wave

same power as the sine wave to be approximated, the amplitude of the square wave must be the sine wave's RMS value. This way, the average voltages, and therefore the power delivered, will be the same for the two waveforms. Square wave inverters are very rarely used in practice, as many devices which utilize timing circuits that rely on something close to the sine wave from the power company cannot operate with such a rough approximation. In addition, a square wave has relatively large 3rd and 5th harmonic components, which burn power and severely cut down on the efficiency of devices using such inverters as a power source.

Modified Sine Wave Inverters

This type of inverter is very high in efficiency and produces a waveform which is an approximation of the pure sine wave waveform that is produced by the utility company. While they don’t produce the same type of power as a pure sine-wave inverter, they work fine in most cases and are also much less expensive. Individuals can use a quality DC -AC inverter to take unreliable power and change it into an AC current that electronic devices can use. This kind of modified sine wave power inverter creates a "blocky" waveform, resembling a set of steps rather than the smooth curves in the waveform produced by the utility company. Nevertheless, this type of DC to AC converter can produce the kind of power that is suitable for most applications.

Modified sine wave is a sales term used for a modified square wave type of AC power which is not quite the same as power company electricity. Modified wave inverters are lower cost, slightly more efficient, and almost all appliances work fine with them, though some may hum louder. But a few sewing machine speed controls and some Apple computers have difficulty on modified Sine Wave. It can also damage photocopy machines, laser printers, and some cordless tool rechargers.

Pure Sine Wave Inverters

They produce power that is exactly like the power which is produced by the utility company without the spikes and brownouts. This type of inverter produces pure sine waves much the same way as the modified sine wave technology mentioned above, but at the cost of some efficiency loss and at a much higher price. In fact, most pure sine wave inverters are typically priced at least 75% higher than their modified sine wave counterparts and, in some cases, do not have as high of a surge capability as do modified sine wave units.

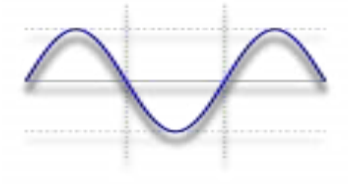


Figure 14 Sine wave

4.2.5 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.

4.2.6 BREAKER

A breaker is an electrical protection device, but they are known to be two, DC and AC breaker, they serve different purposes and distinct characteristics. But DC breaker are mostly used in solar powered system until inverter was introduce, when AC breaker will be needed.

4.2.7 SOLAR RACKING SYTEM

A solar racking system is a structural framework that supports and secures solar panels in place, ensuring optimal energy production and durability. Here are some key aspects of a solar racking system:

Types Of solar racking System:

1. Fixed Tilt Racking
2. Adjustable Tilt Racking
3. Tracking Racking (Single-Axis, Dual-Axis)
4. Pole-Mount Racking
5. Roof-Mount Racking (Flush Mount, Tilt Mount)
6. Ground-Mount Racking

Benefits;

1. Optimized energy production
2. Increased system durability
3. Easy maintenance and repair
4. Customization for various roof types and sizes
5. Compliance with local building codes and regulations

When selecting a solar racking system, consider factors such as:

1. Panel type and size
2. Roof type and condition
3. Local building codes and regulations
4. Wind and snow loads
5. Budget and cost-effectiveness

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

14. 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 are added). Then mount the PV on the rooftop of the building with a few inches 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 30-40P

15. 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.
16. Note: DC loads can be directly connected to the charge controller. After the connection, we move to next step which is connecting the battery.
17. 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.
18. 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. into the battery to AC supply in order to power our AC loads. Connect the battery terminal to the inverter with appropriate cable (minimum of 2.5mm). 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.

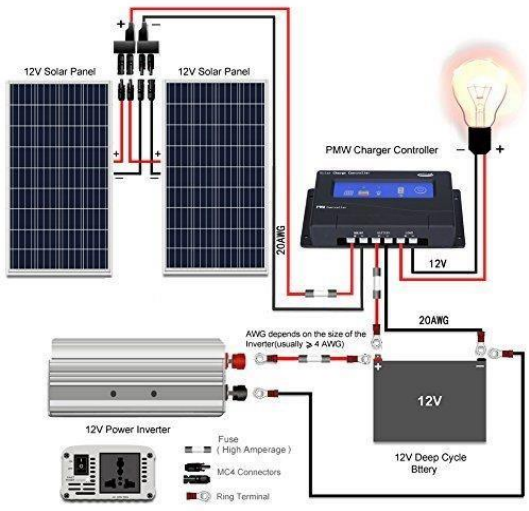


Figure 15 full installation of Solar Electricity

MAINTENANCE OF SOLAR ELECTRICITY 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. For 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.

4.3 BASIC COMPONENTS

Identifying basic electronic components like resistors, capacitors, transistors, diodes, are necessary for an Engineer. We will discuss a little about them here;

4.3.1 CAPACITORS

A capacitor is an electrical component that can store charges.

Types of capacitors:

i. Electrolytic capacitors (Polarized)

ii. Ceramic capacitors (non-polarized)

iii. Paper capacitors

iv. Variable capacitors

v. DC capacitors

vi. AC capacitors

4.3.2 RESISTORS

It is a current limiting device. It can be connected either in series or parallel.

Types:

i. Fixed resistor: they have two legs and they have fixed values unlike variable resistors.
ii. Variable resistor: they have three legs e.g. potentiometer, trimmer, and multi turns.
iii. Special resistors: examples are- light dependent resistors, thermistors, etc.

Various Uses

i. To limit current passing through a component
ii. As a voltage divider
iii. To pull up or pull-down signals i.e. to overcome floating
iv. As bleeders i.e. to discharge electronics components e.g. capacitors

v. In timing circuits

4.3.3 DIODES

It is an electrical component that allows current to flow in one direction

Uses:

i. Rectification: conversion of ac to dc signal
ii. Types: full wave rectification, half-wave rectification, full wave rectification
iii. For voltage regulation
iv. Anti-polarity protection
v. Clamping and clipping

4.3.4 SWITCHES

Types:

i. Mechanical switches
ii. Electromechanical switches (Relay)
iii. Electronic switches (Thyristors, transistors)

4.3.5 SOLDERING TECHNIQUES

This are the steps to take when soldering which include:

i. Scraping the Vero-board to be used
ii. Draw the soldering pattern from the circuit
iii. Getting good jumper wires
iv. Scraping the legs of the components to be used
v. Getting a good soldering iron and soldering led

4.3 MULTIVIBRATORS

They are used for generating waves. The main component used in multivibrators is the NE555 timer IC.

NE555 TIMER IC

IC 555 timer is a well-known component in the electronic circles but what is not known to most of the people is the internal circuitry of the IC and the function of various pins present there in the IC.

IC 555 timer is a one of the most widely used IC in electronics and is used in various electronic circuits for its robust and stable properties. It works as square-wave form generator with duty cycle varying from 50% to 100%, Oscillator and can also provide time delay in circuits. The 555 timers got its name from the three 5k ohm resistors connected in a voltage-divider pattern which is shown in the figure below. A simplified diagram of the internal circuit is given below for better understanding as the full internal circuit consists of over more than 16 resistors, 20 transistors, 2 diodes, a flip-flop and many other circuit components.

The 555 timer comes as 8 pin DIP (Dual In-line Package) device.

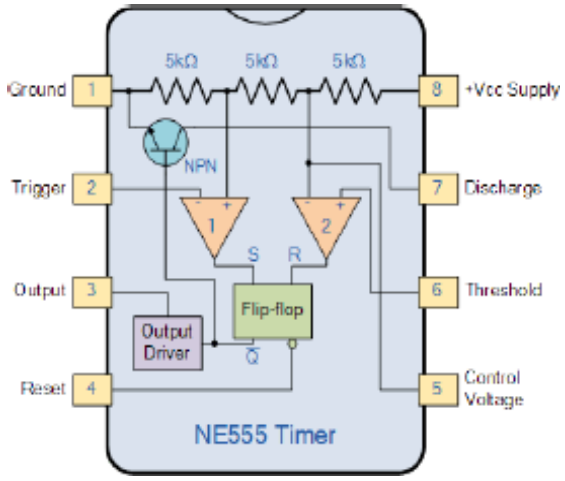


Figure 16 NE555 timer

4.4 ELECTRICAL INSTALLATION & HOUSE-WIRING

An electrical installation refers to the complete setup and wiring of electrical system in a building, including:

1. Electrical power distribution systems
2. Lighting systems
3. Electrical outlet and switches

4. Electrical panels and circuit breaker
5. Grounding system
6. Bonding system
7. Electrical connections to appliances and equipment

4.4.1 METHOD OF ELECTRICAL INSTALLTION

These are ways or dimension in which electrical installation is been done, they include:

1. **Conduit installation:** this involve using of tubes or pipes that protect and routes electrical cables, they can be of metal or plastics, they are used for underground, in-wall or exposed installation and it can be done in two forms namely;
    a) **Full conduit:** in this form, pipes or tubes will be use all through the installation.
    b) **Half conduit:** in this form, pipes or tube are only use in-wall.
2. **Surface installation:** this refers to wiring or cabling installed on the surface of a wall, ceiling, or floor. They are usually attached by clips, adhesive, and straps. They are often use for exposed installation.
3. **Trucking/tray installation:** these are shallow or open channel that support and routes electrical cables typically made of metal, plastic, and fiberglass

4.4.2 STEP IN ELECTRICAL INSTALLATION

1. Planning and design
2. Material selection and procurement
3. Installation and testing
4. Inspection and certification
5. Maintenance and repair

TESTING

Electrical inspection and testing involve a thorough evaluation of electrical installations to ensure compliance with safety standards. This process includes visual inspections, functional testing, safety assessments, insulation resistance testing, continuity testing, and checks on devices like RCDs. The goal is to identify and address potential hazards, ensuring the safety and reliability of electrical systems. Periodic inspections by qualified professionals help prevent accidents, ensure compliance, and extend the lifespan of installation.

TYPES OF TESTING

There are various types of electrical testing, each serving a specific purpose in assessing different aspects of electrical systems and components. Some of the most common electrical installation tests include insulation resistance testing, continuity testing, and ground fault circuit interruption (GFCI) testing.

1. Functional Testing: This is to check whether electrical devices or systems perform their intended functions correctly and efficiently.
2. Safety Testing: Evaluates whether electrical equipment complies with safety standards to prevent hazards such as electric shocks, fires, or other risks.
3. Performance Testing: Assess the overall performance of electrical systems or components under different conditions, including efficiency, capacity, and response to varying loads.

TROUBLESHOOTING

This is the process of analyzing the behavior or operation of a faulty circuit to determine what is wrong with the circuit. It then involves identifying the defective component(s) and repairing the circuit.

Depending on the type of equipment, troubleshooting can be a very challenging task. Sometimes problems are easily diagnosed and the problem component easily visible. Other times the symptoms as well as the faulty component can be difficult to diagnose. A defective relay with visual signs of burning should be easy to spot, whereas an intermittent problem caused by a high resistance connection can be much more difficult to find.

CHAPTER FIVE

5.1 CONCLUSION

My industrial training program at Perfect Seven Global Concept Limited, has helped me to acquire more knowledge about the solar electricity. It helped me to be able to identify, know and connect solar electricity devices to generate electricity.

With this SIWES training, I now have a better understanding of practical application of physics in the aspect of solar electricity generation and I can conclude that without physics, there is no solar electricity system because it all about the basic knowledge of physics.

5.1 RECOMMENDATIONS

The ITF-based SIWES supervisors should endeavor to visit students at their place of attachment regularly. This would keep them abreast of the progress of the students and assist them in areas of challenges.

Regular contact (via email, telephone) should be established between the department SIWES coordinator and the industry-based supervisor for proper monitoring of student's activities.

The department should collaborate with relevant industries in the area of man power training. This would also enable students to secure placement easily.

Adequate funds should be given to IT students by the companies and ITF.

Staffs in different departments of the companies should supervise IT students so that they can understand the operations in the departments easily.