Course: Certificate in Implementing Photovoltaic Systems for Solar Power Generation

Guided Learning Hours: 24

Pre-requisite: Basic Science

Abstract

This unit provides an overview of the operation and installation of Photovoltaic systems. The importance of energy conservation and renewable sources of energy are emphasized throughout this course with particular attention being placed on the generation of energy from the sun using solar panels.

This unit will provide learners with the ability to design and install their own Photovoltaic systems either in residential or commercial buildings. Learning will take place through a combination of lectures and laboratory sessions.

Target Audience

Individuals and technicians wishing to learn about renewable energy, solar power generation as well as the design of Photovoltaic systems.

Learning outcomes

On completion of this course, learners will be able to:

1. Understand the basic principles associated with a Photovoltaic System
2. Understand how energy usage, efficiency and storage affect the design of Photovoltaic Systems
3. Identify and size the basic components which comprise any Photovoltaic System
4. Be able to design simple Photovoltaic Systems to meet specific energy consumption requirements
Course Content

1. Understand the basic principles associated with a Photovoltaic System

   *Introduction to Solar Power and PV panels:* Solar panel construction; Physics of generating power from a PV cell; Building blocks of a PV power system (Stand Alone and Grid); Major players in the solar power industry.

   *Electronics applied to a PV power system:* Electrical terminology; IV characteristics (maximum power point); Use of a Multimeter; Diodes; open circuit and short circuit, continuity of conductors.
   PV cell/module specifications; Effects of temperature on a PV cell/module.

2. Understand how energy usage, efficiency and storage affect the design of Photovoltaic Systems

   *Load Estimation:* Energy consumption (kWh); Energy budget; Energy efficiency.

   *Energy Storage:* Types of Deep cycle batteries and their applications; Battery capacity (AH and depth of discharge, DOD); Battery connection, maintenance and determination of charge; Sizing and installation of a battery bank for a given load estimation.

3. Identify and size the basic components which comprise any Photovoltaic System

   *PV Array:* Positioning and mounting considerations for a PV array; Sizing of PV array to meet load demands; DC voltage and current sizing; Combiner box.

   *Charge controllers and Inverters:* Types of charge controllers and inverters; Sizing of controllers and inverters; Design considerations for charge controller and inverter locations.

   *Wiring and Protection:* Types of wiring used in PV systems; Types of switches, circuit breakers and fuses used in PV systems; Location of Protective devices; Grounding; Electrical codes; Sizing of protective devices and wiring.

4. Be able to design and install simple Photovoltaic Systems to meet specific energy consumption requirements

   *PV system design:* Design a simple PV system by utilizing given data for energy load and manufacturer product specifications.
## Assessment Criteria

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<th>In order to achieve Learning Outcome...</th>
<th>The Learner must...</th>
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| **1. Understand the basic principles associated with a Photovoltaic System** | 1.1 Describe the construction of a solar panel.  
1.2 Explain how power is generated using a Photovoltaic cell  
1.3 Use a Multimeter to determine a diode’s forward or reverse bias conditions and test for open circuit, short circuit conditions and continuity of conductors.  
1.4 Justify the selection of a stand-alone or grid type PV power system |
| **2. Understand how energy usage, efficiency and storage affect the design of Photovoltaic Systems** | 2.1 Determine the energy load requirements for a given site or location  
2.2 Perform calculations to properly size and install a battery bank to meet the storage requirement of a PV system |
| **3. Identify and size the basic components which comprise any Photovoltaic System** | 3.1 Describe various types of charge controllers and inverters  
3.2 Justify the selection of inverters to meet specific design requirements  
3.3 Justify the selection of charge controllers to meet specific design requirements |
| **4. Be able to design and install simple Photovoltaic Systems to meet specific energy consumption requirements** | 4.1 Design and install simple residential PV systems to meet a given energy load demand  
4.2 Use NEC code requirements to select cables, overload and short-circuit protection devices for a PV system |
Essential Learning Resources:

Learners will need access to a wide range of publications relating to renewable energy, photovoltaic systems and solar panels. Various manufacturer products specifications and reference data would also be beneficial to learners. Site visits to PV system installations would be encouraged during the delivery of this course.

Textbooks and Manuals

2. Lab volt student manual

Websites

www.solarpv.com
www.alternativeenergy.org