Course: **Certificate in Implementing Solar Power Systems for Power Generation: Photovoltaic Installer (Level 1)**

Guided Learning Hours: 40

Pre-requisite: **Basic Science Understanding**

Abstract

This unit covers a broad range of information that is valuable to entry-level Photovoltaic installation, including systems components, design consideration, environmental effects and site analysis and for those wanting the basic knowledge and application of solar photovoltaic operation. This course also cover the objectives that is used for persons in the USA seeking to obtain the ETA PV Installer Level 1 as well cover many of the topics associated with the NABCEP Associate level exam requirements, and serves as the base foundation for further development in the Solar industry

A combination of lectures and hands on laboratory sessions is used to deliver the course contents and develop the knowledge and skills to be applied in the industry.

Target Audience

Any Individuals and technicians wishing to learn about renewable energy, solar power generation, design and installation of Photovoltaic systems

Learning outcomes

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

1. Identify photovoltaics (PV) applications and advantages.
2. Identify system components and their functions.
3. Identify safety hazards associated with PV installations.
4. Trace a basic electrical circuit and perform calculations using Ohm's Law.
5. List PV systems sizing considerations.
6. Identify PV electrical and mechanical systems design considerations.
7. Describe the tasks required to complete a site analysis.
8. Identify the effects of the environment on panel output.
9. Describe how to install a simple grid connected and off grid PV system.

10. Explain how to assess system operation and efficiency.
11. Recognize the tasks required when performing PV maintenance and troubleshooting.
12. Identify appropriate codes and standards concerning installation, operation, and maintenance of PV systems and equipment.

Course Content

1. Understand the various PV markets and their applications

History of Photovoltaic effect: How it started, important contributors to PV module and cells design, World PV energy usage, Trends for the future, Popular PV manufactures, Types of PV systems and the basics of how they work, Advantages and Disadvantages, Stand Alone. Grid-Connected, Grid Interactive, Utility-Scale generating systems.

2. Ohms Law and Power

Applying Ohm's Law to series and parallel Circuits, Ohm's Law and Power, Series and Parallel Circuits in Solar PV systems, Peak Sun and Power.

3. PV System Components

PV Panels, Monocrystalline, Polycrystalline, Thin Film, Inverters, Batteries, Charge Controllers and BOS Components.

4. Safety Considerations in PV Systems

Fall Protection, Battery Hazards, Electrical Hazards and Meter Safety.

5. Site Assessment

Customer interview, Power Consumption, Roof Evaluation, Array Orientation and Equipment Location.

6. System Design

Panel Nameplate Data, Solar Array Sizing, Inverter Selection, Battery Bank Sizing, Selecting a Charge Controller and Adjusting PV Conductors.

7. Installation

Forces exerted on the Panels /Support System, Expansions and Contraction, Drag, Wind, Roof Mount Installations, Ground Mount Installations, Electrical System Installations and Assessing System Output Power.

8. Maintenance and Troubleshooting

Loose or Corroded System Connections, Inverter Losses, Heat Fade, Burnt Terminals and Bypass Diodes.

9. Codes and Standards & Emerging Technologies

Introduction to the NEC (National Electric Codes) applied to PV systems.

Assessment Criteria

In order to achieve Learning Outcome…	The Learner must…
1. Identify photovoltaics (PV) applications and advantages	1.1 Describe the various applications and advantages of the different types of PV systems
2. Identify system components and their functions	2.1 Describe various types of charge controllers and inverters 2.2 Describe various types of inverters 2.3 Describe types of Batteries used in PV systems 2.4 Describe different types of Solar Modules
3. Identify safety hazards associated with PV installations	3.1 State the types of hazards associated with working on heights and the means of protection 3.2 Sate the types of hazards with working with batteries and the precautions used
4. Trace a basic electrical circuit and perform calculations using Ohm's Law	4.1 Draw and simple DC electric circuit and perform basic calculations using Ohms Law to determine voltage, current and resistance 4.2 Calculate power in basic DC circuit 4.3 Calculate total voltage and currents for Solar Modules connected In series and parallel 4.4 Determine PSH for country given location
5. List PV systems sizing considerations	5.1 Determine Array size to meet power requirements 5.2 Select and justify Charge controller to meet requirement 5.3 Select and Justify Inverter to meet requirements 5.4 Size Battery bank to meet requirements 5.5 Understand correct wire conductor size to meet system specs
6. Identify PV electrical and mechanical systems design considerations	6.1 Describe the mechanical forces involved in PV systems design 6.2 Identify and understand the electrical wiring schematic from a simple PV System design
7. Describe the tasks required to	7.1 Undertake and complete successfully a Site

complete a site analysis	Survey Checklist 7.2 Conduct and correctly determine a load estimation for a given situation
8. Identify the effects of the environment on panel output	8.1 Describe the effects of Shading on PV power output 8.2 Determine the best tilt angle of a Solar module or array for a given location 8.3 Describe the effects of Heat fade, soiling on PV output
9. Describe how to install a simple grid connected and off grid PV system	9.1 Draw a simple diagram of a grid tie and off grid battery based PV system 9.2 Install an commission a simple /small Off grid system
10. Explain how to assess system operation and efficiency	10.1 Determine Inverter efficiency form manufacturer data 10.2 Determine system losses in due to changes in ambient temperature, panel efficiency
11. Recognize the tasks required when performing PV maintenance and troubleshooting	11.1 Be able to make observations on electrical connections for loose, burnt connectors, lugs and erosions 11.2 Check for ' Soiling ' of Solar panels an clean them, and list relationship to inverter 'losses'' 11.3 Check for bypass diode failure
12. Identify appropriate codes and standards concerning installation, operation, and maintenance of PV systems and equipment	12.1 List the NEC wiring codes applicable to PV Installation

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

1. Solar Power Handbook
2. Lab volt student manual

Websites

www.solarpv.com
www.alternativeenergy.org