



## Photovoltaics (PV) Installer's Course

Rowan University, Glassboro, NJ

June 14 to 17, 2004

### **Instructor: Dr. Gay E. Canough,**

*NABCEP\*-certified PV Installer, ISP\*\*-certified Master Trainer. Gay has taught over 40 PV installer courses and installed over 350 kW of PV.*

#### 1. PREREQUISITIES:

High School diploma

Be able to make simple arithmetic calculations

Must have basic understanding of electricity including familiarity with volts, amps, and AC wiring.

#### 2. TIME and DATE: 8:30 AM to 4:30 PM Monday June 14 to Thursday June 17

#### 3. COURSE MATERIALS:

Specially prepared course notes will be given out at the time of course

#### 4. TOPIC OF COVERAGE:

In this course, we will look at the basics of how to site, design and install photovoltaic(PV) systems. The course includes sizing systems for both grid-connected and off-grid PV systems. We will look at the solar resource, the problems associated with shading and what is the best orientation and tilt for PV arrays. We'll discuss the basic sizing and design of systems to serve a given electrical load. We'll go over safety practices for installers and study the electrical code for PV systems in some detail. We will study various mounting systems for PV arrays and how they affect roofs. We will install a PV system. *This course can be applied toward your NABCEP prerequisites.*

#### 5. WHAT TO BRING

- Calculator
- Volt/Amp meter capable of measuring AC and DC voltage, AC and DC current of at least 20 Amps.
- We'll need some tools for the installation. We'll discuss this before installing day and decide who can bring which tools.

\*NABCEP= North American Board of Certified Energy Practitioners, [www.nabcep.org](http://www.nabcep.org)

\*\*ISP = Institute for Sustainable Power, [www.ispq.org](http://www.ispq.org)

## **Syllabus**

### **DAY 1**

#### Introduction

- Renewable energy overview.
- About energy efficiency.

#### Basic Electrical Concepts In PV Systems

- Current, Voltage, Power, Energy,
- Basic understanding of PV system parts
- The components of a PV system (Module, array, inverter, balance of system)
- The essential miracle of the semiconductor

#### Sunshine Basics

- Path of sun, Finding solar noon,
- What is full sun
- How much full sun is received?
- NREL data bases for estimating system performance
- Best location for PV
- Shading issues
- Effects of off south installation
- Collector angles.

#### Simple Experiments and Demonstrations on

- Using your meters
- Series Wiring.
- Using the Solar Pathfinder

### **DAY 2**

#### Safety

- Electrical
- Working on roofs and ladders
- Batteries
- OSHA

#### Design of PV systems

- System sizing
- Choosing modules and inverters
- System performance estimating

#### National Electrical Code as applied to PV Systems

- Article 690
- Articles referenced by 690

### **DAY 3**

#### Build PV system

#### Permits

- How to deal with town building departments

## Day 4

Mechanical consideration for mounting PV

- Wind loading calculation

- Evaluating integrity of roof

- Mounting of PV panels on roofs racks

Interconnection Requirements

How to obtain an inter-tie agreement with local utility.

Off-grid system considerations

- Battery bank sizing

Trouble Shooting PV systems

- Measuring voltages and currents

- Looking for problems

- Checking performance

Review

Work problems from NABCEP Study Guide so you can pass NABCEP test!

**Registration for ETM Training PV Installer's Course  
Rowan University June 14 to 17**

Last Name \_\_\_\_\_ First Name \_\_\_\_\_ MI \_\_\_\_\_

Street Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_

Home Phone # \_\_\_\_\_ Business Phone # \_\_\_\_\_ E-Mail \_\_\_\_\_

Are you:

\_\_\_\_\_ Solar Installer \_\_\_\_\_ Engineer/Architect

\_\_\_\_\_ Electrician \_\_\_\_\_ Electrical Inspector

Please mail registration form and check/money order to:

***ETM Solar Works, attn: Lori Johnson, 533 Woodford Av, Endicott NY 13760***

*Please register at least two (2) weeks prior to the start of the workshop.*

*All registrations must be accompanied by a check or money order payable to:*

***ETM***

**Registration: \$ 550**

- Morning and afternoon snacks and lunch are included.
- A large binder of notes plus a CDROM of information is included. The PV Systems Engineering textbook is optional, but I will have some available for those that want it (\$75).
- Directions to campus and hotel info can be found at: [www.rowan.edu](http://www.rowan.edu)