



## Photovoltaic Installer Course

Instructors: Dr. Gay E. Canough and Francine V. Notte

### 1. LOGISTICS:

- **Location:** TBD
- **Time:** 8:30 AM to 5 PM – Course will typically begin at 9 AM each day. We ask that you please arrive 30 minutes prior on the first day for registration.

### 2. COURSE MATERIAL:

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

### 3. WHAT TO BRING:

- Textbook: Photovoltaic Systems, 2nd addition, NJATC, American Technical Publishers. Order from [http://www.go2atp.com/Photovoltaic\\_Systems\\_P374.cfm](http://www.go2atp.com/Photovoltaic_Systems_P374.cfm)
- Volt-Amp meter that can measure AC and DC amps and volts. (Up to 10 A)
- NEC 2005 or NEC 2008 book. Available at [www.amazon.com](http://www.amazon.com)
- Safety glasses
- Scientific calculator such as the Casio FX-260Solar (\$10)
- Optional: notebook computer

### 4. TOPICS 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 build a working PV system.

*This course CAN be applied toward your \*NABCEP prerequisites. It is a "board recognized training program" through NABCEP. For NABCEP certification requirements, please visit [www.nabcep.org](http://www.nabcep.org).*

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

## *Tentative Syllabus*

### **DAY 1**

#### Introduction

Renewable energy overview

About energy efficiency

**1 hour**

#### 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

**2 hours**

#### Sunshine Basics

Path of sun, Finding solar noon

What is “full sun”?

How much full sun is received?

NREL databases for estimating system performance

Best location for PV

Shading issues

Effects of off south installation

Collector angles

**2.5 hours**

#### Simple Experiments and Demonstrations on

Using your meters

Series Wiring

Using the Solar Pathfinder

**1.5 hours**

### **DAY 2**

#### Safety

Electrical

Working on roofs and ladders

Batteries

OSHA

**1 hour**

#### Design of PV systems

System sizing

Choosing modules and inverters

System performance estimating

**3 hours**

National Electrical Code as applied to PV Systems

Article 690, Articles referenced by 690

**3 hours**

### **DAY 3**

Build 1 kW PV system

**~4 hours**

Field Trip – TBD

**~3 hours**

\*Please note: You will need to provide your own transportation for the field trip, or car pool with others in the course.

### **DAY 4**

Discussion of build

**1 to 4 hours**

Mechanical consideration for mounting PV

Wind loading calculation

Evaluating integrity of roof

Mounting of PV panels on roofs racks

**1 hour**

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

Permits: How to deal with town building departments

**1 hour**

Off-grid system considerations

Battery bank sizing

**1 hour**

Trouble Shooting PV systems

Measuring voltages and currents

Looking for problems

Checking performance

**1 hour**

Lunch Videos:

The Power of the Sun **1 hour**

Off Grid Design **1 hour**

Surrette Battery Factory **10 minutes**