

WHEN

Feb 2-6, 2015

WHERE

**14th Floor
Lopez Bldg.**

Meralco Center, Ortigas Pasig City

**Facilitator • Sean B. White • 2014 Master Trainer Awardee by
the US Interstate Renewable Energy Council**

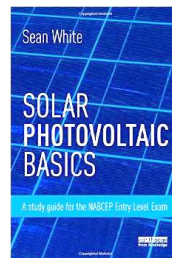
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**BE A SOLAR PV
INSTALLER AND
DESIGNER IN 5
DAYS!!!**

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Sean's Book
(\$32 value for free)
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ABOUT...

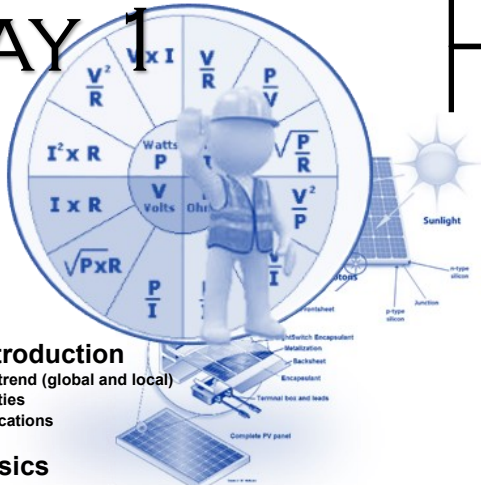
The course is designed to provide comprehensive knowledge on solar PV systems necessary to meet the needs of the emerging Philippine solar industry. Master trainer, Sean White's hands-on program utilizes the NABCEP model, known as the "golden standard" for PV and solar heating installation and PV technical sales certifications. The workshop delivers a unique experience through comprehensive class discussions, actual installation, testing, commissioning, performance monitoring, tuning and troubleshooting of solar PV system. The course also qualifies participants for the US/Canada NABCEP solar entry level exam and the necessary credit units for the NABCEP PV installation professional exam.

Meralco experts/engineers will also be discussing standards and practices on netmetering grid connection and power industry trends.

5-DAY SOLAR PV BOOTCAMP

(NABCEP PV COMPETENCY ALIGNED)

DAY 1



Solar PV Introduction

Renewable energy trend (global and local)

Solar PV opportunities

PV markets & applications

1-Safety Basics

- PV specific safety hazards & the Philippine Electric Code
- OSHA
- PV electrical shock, electrocution and arc flash
- Ladder safety and angles
- Fall protection

2-Electrical Basics

- Electrical circuit components
- Electrical test equipment
- Utility systems, generation, transmission, distribution & electrical service
- Using a digital multimeter to test voltage, current and resistance
- Measuring Voc, Isc and voltage and current under a load
- Using a power meter to make an IV curve

3-Solar Energy Fundamentals

- Making a sun path diagram
- Reading sun path diagrams
- Magnetic vs. true azimuth
- PV shading principles
- Shade analysis tools (Solmetric, Pathfinder, CAD & common sense)
- Shading ratios, 9am-3pm solar window & inter-row dist.
- Irradiance & irradiation measuring devices

4-PV Modules

- Plotting Voc, Isc, Vmp, Imp and Pmp on the I-V curve
- Testing current, voltage, power and energy
- Making IV curves
- Measuring Irradiance and temperature & the IV curve
- Testing load on I-V curve without MPPT
- PV & battery charging
- Similar and dissimilar PV experiments. Module mismatch v. matching modules in series & parallel on I-V curves.
- STC, NOCT, PVUSA, CEC and PTC
- Touching 99.99999 pure refined silicon.
- Examining crystalline and thin film PV module construction
- Testing PV efficiency (commissioning a module)
- Testing PV as a limited current & power source
- Testing bypass diodes
- Understanding and documenting labeling PV standards, CE, IEC & UL

DAY 2



5-Installing System Components

- Turning on PV, inverters, chargers, storage & sources
- Testing anti-islanding
- Installing BOS
- Programming power conditioning
- Installing PV system components for different PV system types
- Small off-grid PV system installation
- Inexpensive phone charging direct coupled systems.

6-PV System Materials

- Choosing your own PV system
- Students will try their skills at choosing PV, Inverters, Racking, etc.
- Finding materials on the internet
- Finding the correct inverters for the Philippine grid.
- Making a materials list
- Instructor will help and critique systems.
- Lab:
 - Shading Analysis with Solmetric SunEye
 - Irradiance Meter & IV Curve Trace

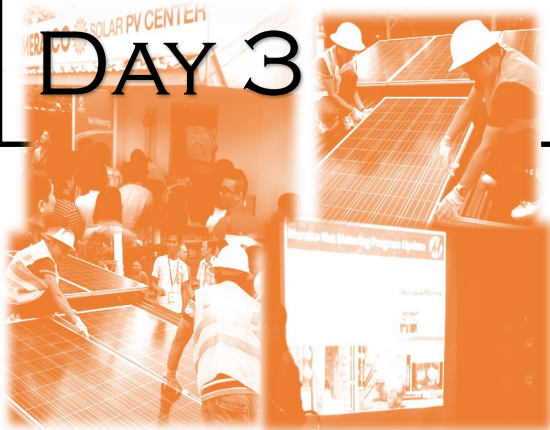
7-PV System Electrical Installation

- Applying the Philippine Electric Code
- Line drawing exercises
- Performing PV series & parallel connections for different applications
- Choosing and using conductors, ampacity, conductor sizing & OCPD requirements
- PV & BOS installation parameters
- Settings for charging batteries with correct current, voltage & rates
- Installing labeling
- Installing grounding systems
- Voltage drop & voltage rise testing
- The process of installing a PV system according to code
- Philippine Electric Code. Looking for code violations

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DAY 3



8-System Mechanical Installation

- Installing Roof, Ground, Pole, Trackers, BIPV
- Compare different types of PV integration
- Installing for PV temperature and wind variables
- Installing Building-integrated PV (BIPV) applications
- Installing materials for a harsh outdoor environment
- Installing roofing & PV
- Estimating mechanical loads
- Mech. installation/components
- Mechanical installation for thermal, orientation & electrical performance
- Installing to manufacturers' instructions & Philippine Electric Code

9-Performance Analysis, Maintenance, Commissioning & Troubleshooting

- Performance problems
- Performance monitoring & parameters
- Expected v. actual performance
- Maintenance
- Operation & Management (O&M) safety
- Most common system failures
- Maintenance planning to manufacturers' instructions
- Dx & treatment of unhealthy PV systems

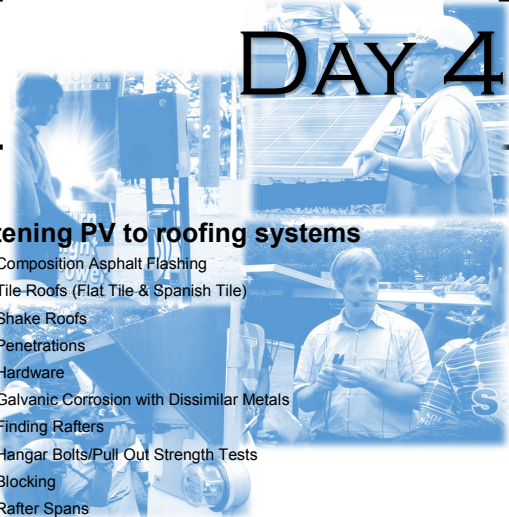
Solar PV NetMetering

- NetMetering rules & guide
- DU Net-Metering application and guide
- Grid connection standards and guide

Hands on PV Installation: Flat Roof Exercise

- Racks, PV, Fasteners, Hardware
- UniRac SolarMount Rails
- IronRidge Rails
- Tilt-up racking system
- PV Module Installation with mid & end clamps
- Grounding with WEEBS, Lugs, WEEB Lugs, Bonding Rails
- PV Source Circuits to Combiner Box
- Inverter Interconnection & Power to Grid
- Testing AC & DC Voltage & Current with Digital Multi-meter
- Breakdown

DAY 4



Fastening PV to roofing systems

- Composition Asphalt Flashing
- Tile Roofs (Flat Tile & Spanish Tile)
- Shake Roofs
- Penetrations
- Hardware
- Galvanic Corrosion with Dissimilar Metals
- Finding Rafters
- Hangar Bolts/Pull Out Strength Tests
- Blocking
- Rafter Spans

Hands on roofing & PV

- Composition Asphalt, Flat Tile & Barrel Tile Roofs
- Methods for Finding Rafters
- Removing Roofing Nails to Make Room for Flashing
- 3.1
- Drilling Holes
- Installing Hangar Bolts
- Waterproofing Gaskets
- Caulking Tips
- ProSolar Racking
- IronRidge Racking
- UniRac ClickSys Racking
- Grounding & Bonding
- Rail Splicing
- Inverter Connection

Hands on PV on Sloped Roofs with Microinverters and AC modules

- Microinverter and AC module Installation
- Microinverter and AC module Grounding
- Microinverter and AC module Monitoring

Breakdown of Sloped Roofs

- 10- Wiring at Panelboard/Inverter Wall & in Classroom
- 120% Rule
- Supply Side Connection
- Breaker sizing
- DC conductor sizing
- Grounding

Solar PV Parts OEM/Supply

- Parts and supply options
- Standard compliance

5-DAY SOLAR PV BOOTCAMP

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DAY 5



Hands on Ground Mount PV Exercise

- ProSolar GroundTrac System
- Installation According to ProSolar Manufacturers Instructions
- 250 series Watt PV Modules
- Measuring Distances
- Hooking up the System to Grounded & Transformer less Inverters 3.1
- Discussion of Combine Fuse Calculations
- Discussion of Conductor Sizing for PV Source Circuits & Output Circuits
- Breakdown of Ground Mount
- Color coding and labeling of conductors

Discussion at Panelboard/Inverter Wall:

- Transformerless v. Transformer Based Inverters
- Differences in Fuse Requirements
- Differences in DC Disconnect Requirements
- Grounded Conductor Requirements
- NEC 2011 Maintenance Disconnect Exception

Other Considerations

- Local rules (LGU, NBCP, PEC, Distribution Code, etc.)
- Standard practices

11- Advanced Topics

Exam preparation NABCEP Practice Exams

Discussion:

Mapping your future. Further study, licensing & certifications

Final Examination & Award Presentation

Discussion:

Mapping your future. Further study, licensing & certifications

Final Examination & Award Presentation

YOUR GLOBAL EXPERT



Master Trainer

Sean White

Certified PV Independent Master Trainer by the US Interstate Renewable Energy Council and NABCEP (North American Board of Certified Energy Practitioners) certified PV Installation Professional.

Sean will also be complemented by

Meralco Experts/Engineers to discuss standards and practices on regulatory environment, NetMetering, Grid connection and power industry trends.

FOR MORE INFORMATION

Contact:

Angie Tibayan or Ara Magdael

Tel: 1622-6758

astibayan@meralco.com.ph;

power.academy@meralco.com.ph

Facebook Page

<https://www.facebook.com/meralcopoweracademy>