RE GENERATION LLC

"Advanced Design and Installation of Photovoltaic Systems"

Instructor Information

David Del Vecchio
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David Del Vecchio has over 16 years of experience and 250 MW of design, installation, operations and maintenance of photovoltaic systems under his belt. He earned a Bachelor of Science in Mechanical Engineering with Honor from the Georgia Institute of Technology in 1992. David has designed and installed off-grid systems with solar/wind/hydro/generator hybrid systems, commercial rooftops and large-scale ground mounted solar farms. David became certified by NABCEP as a Certified PV Installation Professional in 2005. He became certified as an IREC Certified Master Trainer for Photovoltaics in 2010. David has been President of Solar Seed, Inc., since 2006. In this capacity, David provides 3rd party services with design assistance, training, construction QC, inspections and commissioning, performance verifications, operations and maintenance. As a sought-after PV trainer in NC, David teaches for the NC Clean Energy Technology Center, Central Carolina Community College, and for Solar Energy International based in Colorado. He also teaches in Canada, Hawaii and the British Virgin Islands. From October 2011 to March 2014, Del Vecchio was the Senior Engineer for Strata Solar in Chapel Hill. Strata Solar is an EPC operating in the utility ground-mount space as well as the commercial rooftop space. Responsibilities involve quality control: starting with equipment customization and specification, design and engineered drawings, construction QC throughout the project, and commissioning the system. He also creates operations and maintenance protocols as well as protocols for commissioning methods and construction detail procedures.

Course Information

Course Description

Pre-requisite:

Completion of "Fundamentals of Design and Installation of Photovoltaic Systems"

This is a 40 hour course offered by RE GENERATION LLC . This course is the second course after the "Fundamentals of Design and Installation of Photovoltaic Systems" needed to sit for the NABCEP PV Installer exam. Upon completion of both courses your education eligibility requirements will have been satisfied on the journey to becoming eligible to take the NABCEP Solar PV Installer Exam. The NABCEP Solar PV Installer Exam and is based on NABCEP's PV Installer Job Task Analysis. This course is one of eight courses housed under the NC Clean Energy Technology Center's award- winning Renewable Energy Technologies Diploma Series. This 40 hour advanced photovoltaics class covers advanced topics on design and installation of residential and commercial PV systems. This course delves into the details of electrical standards and codes. The bulk of this week-long workshop covers topics relating to the National Electrical Code® (NEC) requirements for PV systems and prepares the participant for proper code compliance, wire sizing, equipment specifications, permit processing, commissioning and other necessary steps in the design and installation phases of residential and commercial systems. Activities in this workshop include designing a multiple inverter commercial PV system, from choosing equipment to processing forms, and a tour of commercial PV systems.

Required Text & Materials

- National Electrical Code book -2014

Structure

This is an onsite course that will be provided using classroom lectures and a few commercial PV system tours.

STDENT LEARNING OUTCOMES. ***Students will be able to:***

1. Apply Grid tied PV system design
2. Identify optimum sites for solar electric systems IV curve tracer; shading live system; Pathfinder
3. Calculate inverter efficiency
4. Navigate and interpret NEC Article 690
5. Identify and interpret required disconnects, combiner specifications, mechanical drawings
6. Calculate tilt angle; inter-row shading
7. Identify best practices for commissioning
8. Troubleshoot ground faults
9. Design and wire diagram a complex commercial scale system

Module	Date	Topic	Assignment Due
1	Day 1	Review system design: Grid-Direct • 3-line wiring diagram review • Deratings – PV Watts review, energy production calculations • Review string sizing • Basics of electrical services and interconnection choices • Lab IV curve and environmental effects vs derates; IV curve tracer; Shading live system; Calculate performance /inverter efficiency, Pathfinder	Review course notes

2	Day 2	Review and Introduction to Code
		• Review lab in-class
		• Review inverter choices for grid-direct small, mid-size and larger systems, and discuss maximizers
		• NEC 690
		  ○ In-depth look at 2011 NEC codebook -
		  ○ 690.16(B) Fuse servicing
		  ○ 690.4(E) & (F) Circuit routing
		  ○ 690.7(A) Informational note on ASHRAE data
			Read assigned NEC articles manual chapters.

		○ 690.8(B) (1) and (2) Overcurrent devices and conductor ampacity ○ 690.11 Arc-fault protection ○ 690.13 Exception 2 - Disconnecting means - all conductors ○ 690.16(A) and (B) Disconnecting and servicing fuses ○ 690.31(B) PV wire conduit fill calculations ○ 690.31(E) DC circuits inside a building • **Site visit to ground mount commercial system**	
3	Day 3	NEC discussion continued • What to expect in NEC 2014 • Transformer-less inverters & ungrounded arrays • Conductor Sizing • Required disconnects, combiner specifications, mechanical drawings • In depth supply and load side connections • Grounding, Article 250, 690 Section V • Sizing EGC, GEC, and grounding electrode system design • Code required labeling	Read assigned NEC articles
4	Day 4	Safe installation and commissioning, troubleshooting • Site analysis (rooftop or ground) • Flat roof racking options/concerns • Ground mount racking options • Picking a tilt angle – inter-row shading • Safety procedures / Installation best practices / Lock out tag out • Commissioning • LAB on ground fault troubleshooting	Read assigned NEC articles
5	Day 5	Wiring Diagrams, monitoring • Ground fault blind spot, what, why and methods for mitigation ○ Residual current monitoring • Commercial systems - Design and draw a 3 line wire diagram for a complex system • Monitoring options inverter, third party, wireless, etc • Webinar – Surprise guest • Common install errors/code violations	Take and Pass Final Quiz

Attendance

Policy

Students are responsible to keep up with course materials and meet course required deadlines. Per the University, attendance will be taken at every class. Students must be present **90%** of the class in order to receive credit for the course.

Assignments & Quizzes **In order to pass the class students must, at a minimum:**

1.) Achieve a minimal **75%** final assessment

Students who successfully complete course:

1.) Receive a Certificate of Completion for the course

2.) Have satisfied the advanced level education requirements on the pathway to becoming NABCEP certified

3.) Eligible for continuing education credits: 40 hours for PDH and 24 for Licensed Electrical Contractors

If you have concerns or suggestions for this course, please contact Maria O'Farrell, NC CETC Training Program Manager (mdofarre@ncsu.edu@ncsu.edu).