Integrating Hands on Labs into PV Curricula

IREC CLEAN ENERGY WORKFORCE EDUCATION CONFERENCE 2011
AltE U. Presenter

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- AltE U
  - ISPQ Accredited Training Program
  - Classroom and Lab facilities in Columbus, OH and Hudson, MA
Why have hands on labs?

- Provides a break to the monotony of classroom teaching
- Provides tactile learning for those that learn best through doing things
- Enables students to get their hands on real world equipment
- Enables students to work in a safe and closely monitored environment
- Allows the ability to isolate key parts of a PV system in a controlled environment
Break up the monotony

- The majority of our students at AltE U are adults
- PV system design is highly technical
- Without breaks, the students tend to get “glossed” over
Break up the monotony

- Labs and system walkthroughs provide needed breaks in the classroom teaching
  - This can be in the form of a hands on lab or maybe just a walk through of a code compliant system
    - There is value in showing both energized and de-energized systems
Everyone has different preferences for learning
- Visual
- Auditory
- Tactile

Combining lecture and presentation materials with hands on aspects we help to satisfy all three learning styles
Tactile learning

- Especially important when teaching students with minimal experience with electricity and/or construction
- Always remember to follow “best practices” and use appropriate tools and personal protective equipment
Real world equipment

- Use equipment that is currently available on the market
- Also try to use a variety of different manufacturers
  - Fake or “dummy” equipment is often available
  - Fake batteries are very helpful to show proper battery wiring
- PV equipment is often unique

Series / Parallel Wiring Lab
Real world equipment

- Always make sure that labs are designed, constructed and installed in a code compliant fashion
- Always use listed equipment when available
- If any parts of a lab are not code-compliant make sure to disclose that to the students
Whenever possible we try to make sure we are working with de-energized systems unless we need to show current flow

- PV module wiring labs are done indoors
- Fake batteries are used
- Eliminate any possible sources of current unless needed
In order to keep lab groups manageable we always use multiple instructors and call in extra instructors when needed for labs.

We like to limit our labs to a 6:1 student to teacher ratio.
Isolate key parts of the system

- Labs enable the instructor to isolate key parts of a PV system in order to reinforce the learning objectives being taught in the class

Series / Parallel wiring lab:
Reinforce PV Source circuit theory
Isolate key parts of the system

- **Grid Tied Inverter Wiring lab**
  - Focuses on PV Output circuit and Inverter Input and Output circuits
AltE U. Hands On Labs

- Site analysis
- Module Testing
- Series & Parallel wiring – PV Modules
- Series & Parallel wiring – batteries
- Off-grid system walk-through
- Grid tied system walk-through
- Module mounting – flush roof, pole, ballast
- Grid tied inverter wiring w/ DC & AC Disconnects
- Roof Penetration lab
Thanks!

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