SP.721 (D-Lab) Fall 2004
Session #21 notes

Lab: Solar Energy and Lighting

In this class session, students rotate among several stations intended to illustrate different aspects of solar energy and lighting technologies.

[These notes provide rough suggestions on the procedure, measurements and observations intended for each station. Only a couple of stations were photographed in use. Note: this was the first time this lab was included in D-Lab, and in subsequent terms the stations will probably be modified and refined.]

Station 1: Introducing Photovoltaic Systems

Procedure

1. Turn on halogens, point at panel
2. Hook up panel to multi-meter (voltage)
3. Rotate panel and move lights to see what happens to voltage
4. Hook up motor to panel
5. Have students grip shaft of motor
6. Rotate panel and move lights to see what happens

Measurements and observations

- Max Voltage unloaded
- Min Voltage unloaded
- Max Voltage with motor
- Min Voltage with motor
- Max Current through motor
- Min Current through motor

Station 2: Integrating Batteries into Photovoltaic Systems

Procedure

1. Shine lights on panel
    a. measure voltage on leads
2. Hook up panel to motor and shine lights on it
    a. check voltage on motor leads

    b. check current through motor
3. Measure voltage at battery leads with multi-meter
4. Hook up battery to motor in series with ammeter
    a. measure current through motor
5. Hook up battery to motor
    a. measure voltage on motor leads

Measurements and observations

- Panel:
    - Voltage on panel unloaded (max)
    - Voltage with motor
    - Current through motor
- Battery:
    - Battery voltage unloaded
    - Current through motor
    - Voltage on motor

Station 3: Light

Procedure

1. In a windowless room, turn out all the lights, then light a candle and discuss what you could do by this light.
2. Turn on incandescent light and measure with light meter at specific distance
3. Use this value as reference value
4. Turn on other light sources:
    - candle
    - propane lantern
    - compact fluorescent (CFL)
    - red and white LEDs
5. Have the students predict the light meter readout in relation to what you got from the incandescent light.
6. Talk about the energy that is producing this light output.
7. Also notice variation in room coverage – how sources with similar meter readings vary in how well they illuminate the room.

Measurements and observations

- Light meter value for incandescent lamp

- Distance from lamp
- Guesses for Candle
- Actual for candle
- Guesses for Lantern
- Measurement for Lantern
- Guesses for CFL
- Actual for CFL

Station 4: Battery Care

Procedure

1. Talk about how batteries work --- diagram
2. What happens when you charge/discharge? (chemically)
3. What happens when you discharge too deep?
4. How do you take care of a battery?
5. Open up the battery and show them what they might do to take care of it

Station 5: Current and Voltage Relationships

Procedure/Goals

- Understand/measure current vs. voltage
- Internal resistance of batteries – power loss in charging/discharging
- How many batteries for given load?
- Charge controller – connect it

Measurements and observations

- Charging Current
- Charging Voltage
- Discharging current and voltage
- Internal resistance of battery

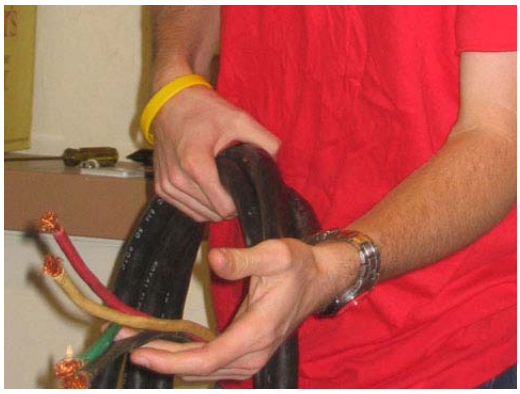
Station 6: Wiring for Photovoltaic Systems

Procedure

- Wire up motor with alligator clips and gel-cell
- Measure current when running motor
- Hook up with small wire
- Grip shaft and heat-up and blow wire

Measurements and observations

- Normal Wire:
    - Current with motor shaft unloaded
    - Current with motor shaft slowed
    - Current with motor shaft stopped



- Small Wire:
    - Current with motor shaft unloaded
    - Current with motor shaft slowed (lower left photo)
    - Current with motor shaft stopped (lower right photo)
    - Max current with small wire