Generating Off-Grid DC/AC Solar Power

Laboratory Experience

Solar Energy | Water | Environment
Nexus IN NEVADA

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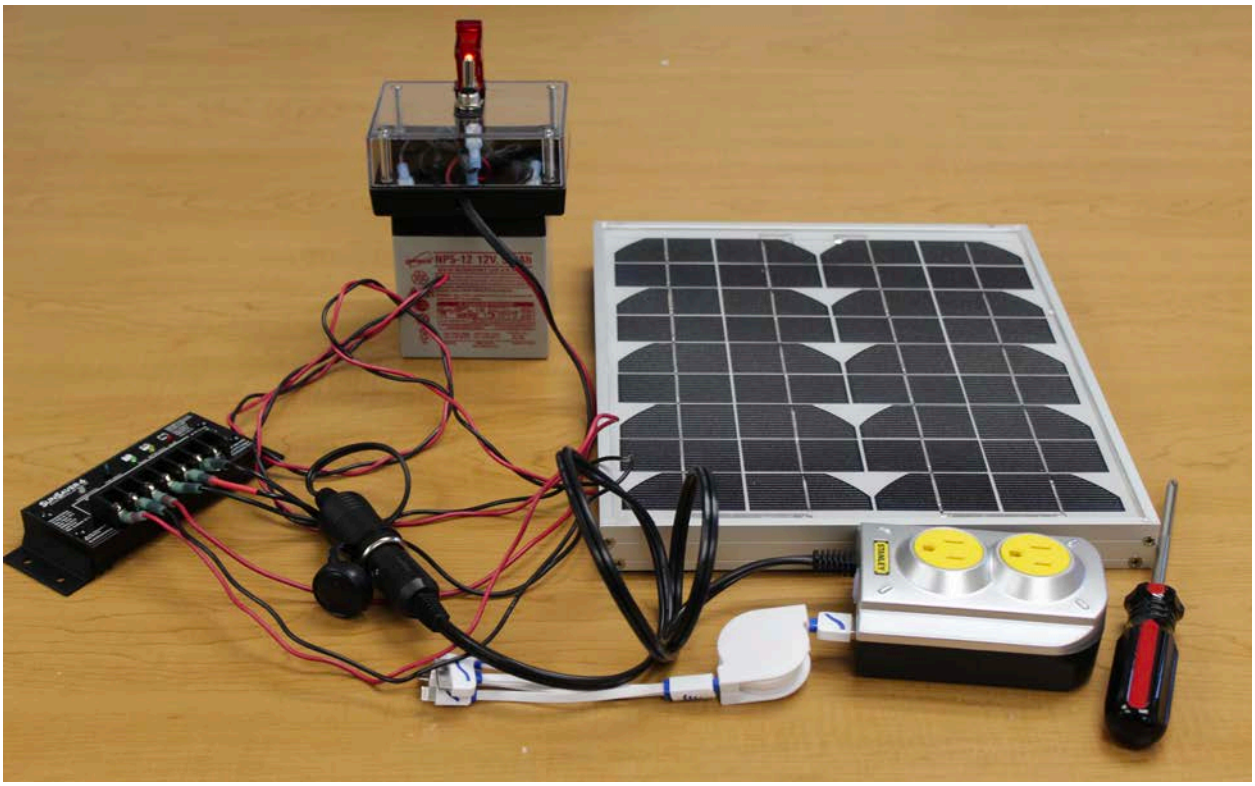
Objectives

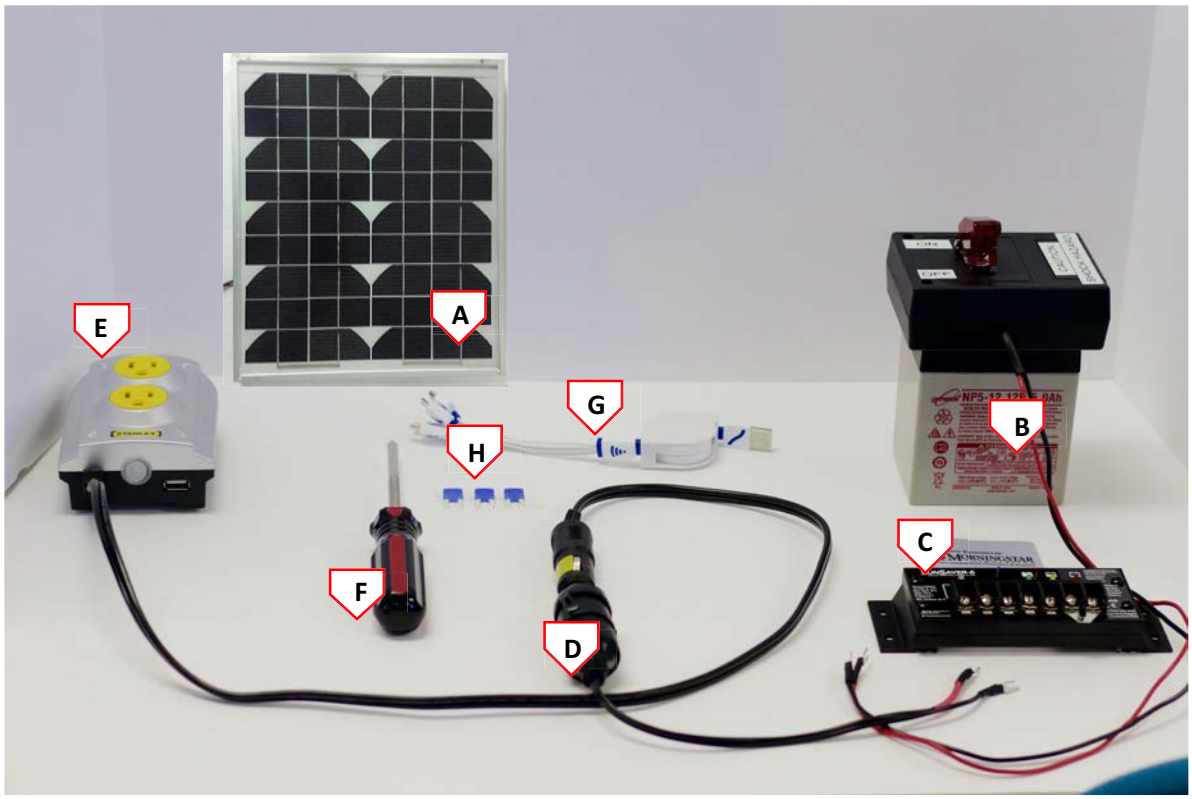
This kit is designed for middle school students to learn about solar energy and electricity. The set-up and tasks are moderately difficult, but should be attempted by the students directly. Adult supervision is necessary to avoid potential injuries (e.g. shock, burn) and damage to the equipment (e.g. stripped screw).

Key concepts covered in the activities include:

- conversion of energy forms
- electricity flow



Off-Grid DC/AC Solar Power System
Materials and Diagram



A – Photovoltaic Unit (PV Panel)
B – Battery
C – Solar Charge Controller
D – Auxiliary Power Port Adapter
E – Inverter
F – Screwdriver
G – Cellular Device Charger
H – Extra Fuses

9) Flip the switch on the battery to the ON position. The lights on the Charge Controller will light up.

10) Push the button on the bottom of the Inverter. When the Inverter is ON, the button will illuminate **blue** (*Figure 8)*.

11) You have now connected the Off-Grid System! There are two outlets on the front of the Inverter that can be used to power a small AC device. Additionally, there is a USB port next to the illuminated light that can also be used to power a small device via USB.

Figure 8 – Invertor button illuminated

Experimental Procedure

1) Check to make sure all wires are connected properly into the Solar Charge Controller.

2) Turn over the photovoltaic unit facing the sun. Ensure it is receiving DIRECT sunlight. No shade should be covering the panel.

   Note: If it is a cloudy day, this may affect the outcome of the experiment, as it may not have enough power to sustain the system.

3) Using the inverter, plug in the cellular device charging cables into the USB port of the inverter.

4) Plug in a cellular device to ensure the system is working properly.

   If the cellular device does not show a charge, here are a few troubleshooting tips:

   a) Ensure that everything is wired correctly.

   b) Ensure that the inverter is on and illuminated.

   Continue to the next step once you know the cellular device is charging.

5) Turn the battery **OFF**. Make sure you close the lid of the switch to keep it secured.

   Is the cellular device still charging?

6) Turn the battery **ON** and remove the panel from the sun. (Place it face down, with the cells facing the table or surface).

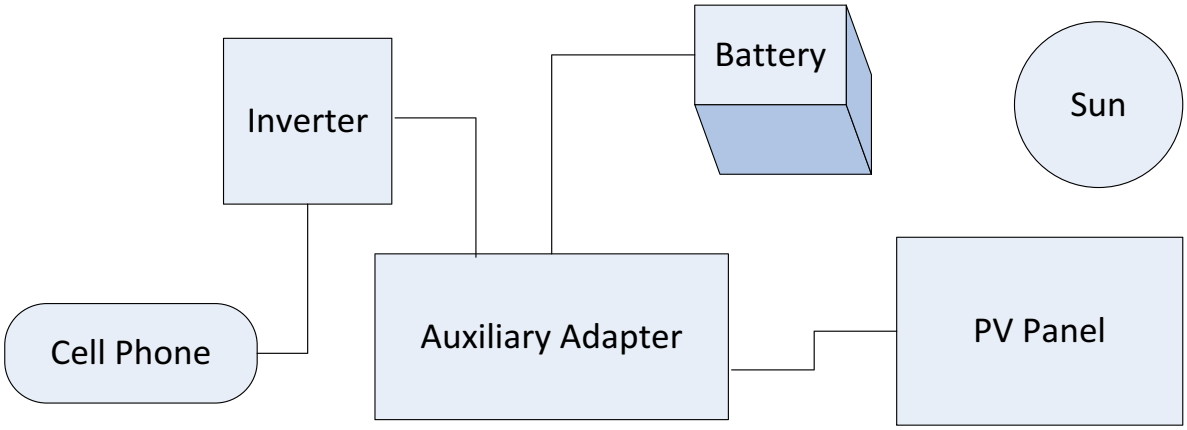
   Is the cellular device still charging?

7) Document your observations.

Electricity Flow

Consider the first situation. The battery is **on** and the PV panel is **face down**.

- What item is the power source?
- What type of energy is the power source?: radiant, thermal, sound, electrical (light) and mechanical (motion), chemical potential, gravitational potential, nuclear potential, elastic potential
- Identify the energy form changes.
- Diagram the flow of electricity with arrows. (This is the direction that the electrons flow)



Consider the second situation. The battery is **off** and the PV panel is **facing the sunlight**.

- What item is the power source?
- What type of energy is the power source?: radiant, thermal, sound, electrical (light) and mechanical (motion), chemical potential, gravitational potential, nuclear potential, elastic potential
- Identify the energy form changes.
- Diagram the flow of electricity with arrows. (This is the direction that the electrons flow)