

Lesson #8 ...

The Materials and Tools Needed to Build a Solar System

By David Sieg and Information Specialists Corp. Copyright 2008

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Before attempting to build a solar system for your entire house, take my course "Home Energy Made Easy" Go here: <http://Off-Grid-Living.com> I'll give it to you for free for being a member of this course. Understanding the concepts in that course will save \$1000's of dollars when you go to build your system.

This is but one small section of a complete action plan for building solar panels dirt cheap. Which is one small section of a course on going off the grid in Urban/Suburban America. You can learn how to

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Introduction

The most important thing to take away from this lesson is..

Most home workshops have all the tools necessary. Parts for your first panel are going to be minimal.

This part is about understanding and learning about system components—solar cells, modules, and balance-of-system parts.

When considering your budget the major parts you need to ask yourself two questions:

- Will your system be grid-tied, or A stand-alone, or off-grid system?
- Will you buy panels, or build them?

For the purpose of this course, we'll assume you're building your own panels, using a grid-tie system with battery backup. However, note, batteries are optional. I also show you how to get free batteries at the end of this course.



Solar cells: How many you need will depend on the size of the system you're creating. My advice is to build one solar panel as a prototype as I'm going to show you in this course, test it, and decide from there how many you want to build.

- **Inverter:** Solar PV panels produce direct current (DC) power, which must be converted to alternating current (AC) power which is supplied by electric utilities in the United States. This is accomplished by an inverter.
- **Mounting racks and hardware for the panels:** Mounting racks and hardware for panels: You can buy these commercially, or build your own.
- **Wiring for electrical connections:** You'll need wire for connecting your solar panels to your inverters as well as other parts of your system and house.
- Batteries for electricity storage (optional).

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Batteries or no batteries?

Is a Battery Bank Really Needed?— The simplest, most reliable, and least expensive configuration does not have battery back-up. Without batteries, a grid-connected PV system will shut down when a utility power outage occurs. Battery back-up maintains power to some or all of the electric equipment, such as lighting, refrigeration, or fans, even when a utility power outage occurs.

With battery back-up, power outages may not even be noticed. However, adding batteries to a system comes with several disadvantages that must be weighed against the advantage of power back-up.

These disadvantages are:

- Batteries consume energy during charging and discharging, reducing the efficiency and output of the PV system by about 10 percent for lead-acid batteries.
- Batteries increase the complexity of the system. Both first cost and installation costs are increased.
- Most lower cost batteries require maintenance.
- Batteries will usually need to be replaced before other parts of the system and at considerable expense.

For a grid-tie system you may also need depending on your location and utility regulations:

- Grounding equipment
- Combiner box
- Surge protection (often part of the combiner box)
- Meters – system meter and kilowatt-hour meter
- Disconnects:
 - Array DC disconnect
 - Inverter DC disconnect
 - Inverter AC disconnect
 - Exterior AC disconnect

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If the system includes batteries, it will also require:

- Battery bank with cabling and housing structure
- Charge controller
- Battery disconnect

Material needed

Materials needed to build a solar panel

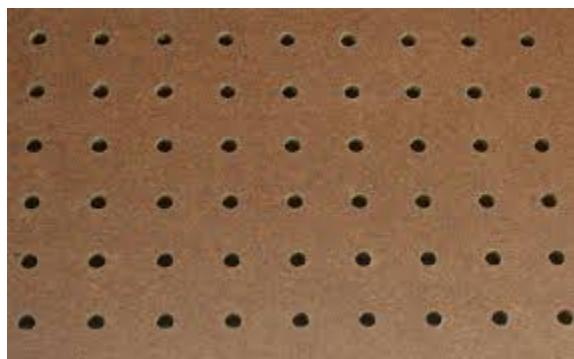
- **(36) 3"x6" Solar Cells**

Your options here are many. So to narrow it down, ask yourself two questions: Do you want to buy cheap solar cells and fix them up? Or you want to buy brand new solar cells?

The first option is buy cheap solar cells, for pennies, and do minimal work to fix them up. There is possibility of getting blemished or slightly broken cells for next to nothing. While it may not look as pretty when your solar panel is completed they can work just as good as new ones. The only downside is that it usually means a reduction in energy output from the cell and your panel.

Of course, you don't have to do that. You could spend a little more money and buy new solar cells...there are still cheap. But I going to assume you want to do this as cheaply as possible.

There are also several different sizes to consider. The majority of DIY projects are done with 2"x6" cells, 3"x6", or 6"x6" cells.



- **2'x4' Plywood AND pegboard**

I'd start with a half sheet...in other words 2 foot by 4 foot. You don't need the expensive stuff, either. This size is easily workable and fits well on a work table. In the beginning, I'd make them smaller and easier to work with. The beauty part of

this is once you made a couple, you'll see how easy it is to make them any size you want.

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- **1" (inch) X 1" (inch) wooden border**

This needs to be enough to go around the entire outside of the plywood. You're going to use this as anchor to fix your Plexiglas too. This can be bought cheaply, found around the house of woodshop, picked up a the dump,etc.

- **2'x4' Flexiglass and/or Plexiglass:**

You'll need this to go over the outside of the unit. So get one 2' (foot) by 4' (foot). You can get these usually at any hardware store.



- **60' Tin coated tabbing wire:**

You'll use this to connect the cells to together. You can buy this cheaply off of eBay once again.

- **1 tube Silicone: (transparent)**

You'll use this to hold the hold the solar cells to the plywood and the plexiglass to the border. It also makes a great waterproof seal.

- **1 roll of Solder:**

You'll use the solder to securely anchor the copper wire onto the back of the solar cells. The tin coated tabbing wire will usually hold itself down but you may need extra solder to tack various places down.

- **Rosin flux pen:** This is used to help the wire stick to the cells



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- **UV Protector sealant (white):**

The Plywood should be painted with a UV protector so that it will last longer out in the sun. Any kind will do, but you should use high quality as it will be exposed to sun all day. A light color is preferred so it will reflect, and not absorb the heat.

- **Wood glue.**

When you're constructing your frame, some people like to have some glue to hold the pieces together, prior to tightening them. I don't do it that way myself, but a lot of people seem to prefer it.



Tools you'll need for this job are

- **Volt meter:**



You're going to use this to test the cells power output. Once you connect the cells together you can check the voltage flow as you go. They should increase with each new cell connected. And measure your output once you've completed the panel. You can buy these cheap at Harbor freight tools, or even Wal-Mart.

- **Pencil style solder iron:**

Once again, these can be bought cheaply at harbor freight tools, Northern tools, Walmart, just about anywhere. Try to get the pencil style as opposed to the regular style. It makes this job much easier.

- Crimping pliers
- Tile spacers
- Power drill

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- Drill bits
- Hand saw
- Tape measure
- Hammer
- A box of 3" and 1" wood screws

Nice to have but not necessary:

- **Jones plug**

A Jones plug is a set of male and female plugs that are used to connect wiring from a solar panel to a charge controller, so you are not hard wired directly to the charge controller. This makes it easy to disconnect the two from each other, in the event you want to move the panel or system altogether.



Except for the solar cells, most of these parts and tools can be bought at harbor freight tools, or your local home improvement store. Don't worry about taking notes, there is a downloadable handout that is in the resource section to bring to the store with you.

PS...Don't forget you can get personalized coaching at Off-Grid-Living.com/
For some this is the ideal way to get hands on experience as well as personal attention needed to make this work for you.

Coming Up Next ...

Lesson #9: "Where to Buy Parts and Materials"

If you don't have all the tools necessary, don't worry. In the next lesson I'll show you where to buy everything you'll need dirt cheap.

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