THE CABIN DEPOT

BEGINNER'S GUIDE
to off-grid solar power

Solar power can be confusing, so we've prepared this guide to help answer the most common questions in very simple, non-technical, easy to understand language. The first step is to understand what off-grid means, and the differences between off-grid and on-grid solar power systems:

Off-grid systems are autonomous, meaning they are designed to be completely independent of the local power utility. These systems are used for off-grid homes, cottages, cabins, RV's, boats, and other applications where access to grid power isn't possible or impractical. These are the systems that The Cabin Depot™ specializes in.

On-grid systems use solar panels to offset energy consumption in your home. These systems, also known as **'grid-tied'**, require the approval of the power utility, site inspections, and certified electrical contractors to install. The Cabin Depot™ does not offer these systems today, but we can recommend companies in your area who would be happy to help.

So if your application is for off-grid use,...read on!

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OFF-GRID SOLAR POWER SYSTEM COMPONENTS

All off-grid solar power systems are made up of four key components:

1) **Solar panels** = converts sunlight to DC (Direct Current) energy, and charges batteries.
2) **Batteries** = stores the DC energy that is produced.
3) **Charge controller** = ensures proper charging of the battery bank.
4) **Inverter** = converts DC energy to household 120/240vAC (Alternating Curent) power.

Tip: People get very excited over solar panels, often rushing out to buy them first before properly sizing their system. But the reality is your batteries are the most important component of an off-grid power system!

The size and type of these components will depend primarily on the electrical loads that you want to service. This can be confusing as the jargon can become more technical, but here's the **bottom line:**

To significantly reduce the size and cost of a solar power system, you want to avoid (when possible) powering any appliances or devices used for heating or cooling air, water, and food electrically.

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ELECTRICAL LOADS

Electrical loads are the things that you will have "plugged in" to power, such as...

Small loads:	Large loads:
LED lights	Keurig coffee machine
LED televisions	Microwave
Satellite receivers	Hair dryer
Radios	Hot plate
Cell phone chargers	Air conditioner
Small diaphragm water pumps	AC powered refrigerator

When it comes to solar power equipment selection, you must consider your electrical loads. Your total investment will be lower when powering small loads because you won't require as much energy. You can still power large loads, but your system components will need to be larger in order to store more energy. This will be reflected in the size of your system, as well as the cost.

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REDUCING ELECTRICAL LOADS

Heating — Use wood or propane as your primary heat source. Heat water using an on-demand propane tankless water heater.

Cooling — Install a propane or solar/DC refrigerator, or select a smaller portable solar AC/DC powered fridge/freezer.

Cooking — Cook on an off-grid propane range.

Refrigeration is usually the largest consumer of power in an off-grid application. A typical household refrigerator uses 120vAC to operate. They usually have auto-defrost, ice makers, and other accessories that ramp up energy consumption. Even a basic 120vAC refrigerator will be rated for around 250 watts operating, with a surge (when the compressor starts) approaching 1000 watts. Furthermore,in an off-grid application, you would be using DC power from your batteries and converting that to AC power via an inverter to run your refrigerator. Inverters suffer from conversion loss, so you can count on 'wasting' anywhere from 5% to 15% of your energy through this conversion. As such, customers wanting to run an AC refrigerator will need to invest in a larger solar power system to operate it, which typically costs more than replacing the refrigerator with a solar/DC model designed for off-grid use.

A solar/DC refrigerator is designed with energy efficiency in mind. They have more insulation, a specially designed DC compressor, and connect directly to your battery bank. Since there's no inverter required, there is no conversion loss to worry about. There are many models of solar/DC refrigerators, but most are rated for around 55 watts when operating. So as a customer, you're able to use a much smaller solar power system to operate one.

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ESTIMATED SOLAR POWER SYSTEM COST

Much like buying a car, your budget and lifestyle will determine how much you will eventually spend on a system. And just like buying a car, there are many options and accessories available for solar power systems. If you want more bells & whistles, or more convenience, you'll spend more money.

Small system:

- Uses 12vDC battery power only (no inverter required).
- All electrical loads connect directly to the battery bank.
- 12v LED lights, 12v water pump, 12v ceiling fans, 12v refrigerators, etc.
- Typically used for hunting camps, weekend-use cabins, RVs, boats, etc.
- A small inverter could be added to run a TV or radio or a few hours at a time.
- **Approximate cost: $350-$2000 for a complete system.**

Medium system:

- May combine 12vDC and 120vAC power.
- Typically used in seasonal cottages, camps, or cabins where you may spend weeks at a time.
- Most commonly will use a gas or propane generator to run larger load items as needed (coffee maker, hair dryer, etc). This is more cost efficient than increasing your solar system size. If you don't want to use a generator, add ~$1000 to the cost.
- **Approximate cost: $1000-$3500 for a complete system.**

Large system:

- Uses 120 and/or 240vAC power.
- Typically operate household electrical loads year-round.
- Some exceptions, such as electric baseboard heat, electric ranges, or electric clothes dryers. They are usually replaced with propane models.
- Northen climate off-grid houses will always have a backup gas or propane generator, used ocasionally in the winter to charge battery bank after consecutive days of poor weather conditions.
- **Approximate cost: $7500 (with careful energy management) to $20,000+ for a complete system.**

It's important at this point to remind you again that every solar power system is as unique as the individual using it. Buying a "kit" that is too small or not expandable will leave you without power when you need it the most and limit your ability to expand. Buying a kit that's too large for your application is just a waste of money. So, remember - BIGGER IS NOT BETTER! Our primary goal is to ensure your off-grid solar power system is suitable for your specific application and lifestyle, so we always recommend building it for future expansion. That way you can start off with what you 'think' may work and add to it in the future without having to replace all of your key components or wiring.