# Sunny Prospects for Remote Log Homes

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Good land is getting harder to find. While this isn't exactly hot news, it's still frustrating for those of us searching for the perfect acreage to build a custom log home. Often we discover the land we want is so far from the nearest power pole that the cost of running power to the home site is prohibitive. Not too long ago this was a real problem; the technology used to produce electricity from solar and wind sources was expensive and unreliable.

But not anymore.

These days it's possible to harness renewable energy sources to power remote homes with homegrown electricity that's as steady and clean as that provided by the local electrical utility, and for a cost that can be factored into almost any budget. Today's solar panels are cheaper and more efficient than ever. Advances in wind technology have provided the homeowner with wind turbines that are essentially maintenance free; turbines that can produce usable power in a 7 mph breeze. Modern power inverters have been engineered to operate any energy load a homeowner is likely to run, and today's battery technology has produced batteries with lifetime expectancies of well over 15 years.

And if all of this isn't enough good news, consider this: the proven thermal efficiency of log homes makes this age-old building practice perfect for conserving the energy produced from renewable sources. Even though you won't be heating your off-grid log home directly with electricity, the natural tendency of logs to absorb heat when the ambient temperature inside the house is warm—then radiate it back as the temperature drops—makes log homes ideal for powering with solar and wind energy sources.

To understand exactly why this marriage of ancient craftsmanship and modern technology is such a natural one, we will first need to examine how usable electricity is extracted from the sun and wind, then explore how this exciting technology relates so favorably to log homes.

**Understanding Renewable Energy**

All modern homes in America run on alternating current (AC), which is electricity in the form of a sinusoidal wave. It's called "alternating" because the wave flows smoothly from a positive crest to a negative trough, and back again, 60 times per second (i.e., 60 hertz). Alternating current was adopted as the nation's standard over 100 years ago when it was determined that AC could travel much longer distances, with far less loss through transmission lines, than direct current (DC), which is simply a non-pulsing stream of electrons.

As adept as AC is at traveling great distances, however, it does have one major drawback: it cannot be stored in a battery (as chemical energy) for future use. To store electricity, you must charge the battery with direct current; later, when you need to use it, the DC is converted to AC.

A modern renewable energy system has four primary components: the charging source (solar array or wind turbine), the charge controller, the battery bank, and the power inverter.

### *Charging Sources: Solar Panels and Wind Turbines*

Modern solar panels (more correctly called modules) are available in a broad range of styles and types. The one thing they all have in common is their ability to produce electricity from sunlight. This is achieved by "doping" silicon with thin layers of materials with dissimilar electrical properties. When sunlight strikes the panel it knocks electrons free and creates an electrical current between the two opposing layers. This current then travels to the batteries—via a charge controller, which will be discussed below—where it is stored for future use.

A group of panels wired together form an array. While it is customary for us to envision arrays as being mounted on a south-facing roof, most arrays are actually located on the ground. For snow removal, cleaning, and seasonal adjust-ments to maximize the array's exposure to solar radiation, a ground-mounted array is the best.

Several innovative developments have been introduced in the last few years. While standard solar panels—which are still the norm, and probably will be for years to come—have become cheaper and more efficient, other products have been introduced that are far less conspicuous than a standard array.

*UNI-SOLAR*®, for instance, manufactures a line of products that serve the dual purpose of providing your house with electricity, while protecting it from the weather. These products replace as much, or as little, of the roof as you wish. Whether you plan to install a standing-seam metal roof, or one with conventional shingles, you should be able to find a solar product made to work with your particular application.

While the electrical needs of most remote homes are met entirely with solar energy, there are many places where the addition of a wind turbine can be quite beneficial. Hilltops and mountaintops, and broad valleys, which are often troughs for the swift passage of air from higher to lower altitudes, are ideal places for harnessing the power of the wind.

Today's wind turbines are sleek, efficient workhorses. New turbine and propeller designs, coupled with sophisticated electronics, make these advanced machines useful additions to any remote home with reasonably steady winds. Available in sizes ranging from 400 to 3,000 watts, you can harness as much, or as little, of the wind and you feel is practical. With an average wind speed of 10 mph, for instance, a good 1,000-watt turbine will produce upward of 100 kilowatt hours of electricity per month.  This is a sizeable percentage of the electrical usage of any remote home where basic, pain-less, energy conservation practices are in use.

### *Charge Controllers*

Before the electrical current from the solar array and the wind turbine reach the batteries, it is first routed through a charge controller. The basic job of the solar charge controller is to charge the batteries without overcharging them, and to prevent current from flowing backwards from the batteries into the solar array during the nighttime hours. More sophisticated charge controllers can also convert excess array voltage into usable amperage, a particularly useful feature during the winter months, when arrays typically operate at higher voltages.

Like solar charge controllers, wind charge controllers prevent the batteries from overcharging, but do it by different means. Since wind turbines cannot simply be disconnected from the system without the risk of damage to the turbine, wind charge controllers shunt excess power into a heat sink, where it dissipates harmlessly. Some of the smaller wind turbines on the market today do away with the need for a separate charge controller and heat sink by automatically slowing the propeller as the batteries become charged, stopping completely when full charge is achieved.

***Batteries***

Many people who would otherwise embrace renewable energy with open arms instead fold their arms across their chests when the discussion turns to batteries. The thought of having an entire bank of the same leaky, smelly corroded things they find under their car hoods inside their houses is just too unsavory to contemplate. The fact is, however, that a battery kept inside your home at a fairly constant temperature neither leaks nor smells, and the terminals do not corrode, so long as the batteries are not overcharged (the function of the charge controller) or overfilled with water.

Battery banks are sized to give the homeowner enough spare power to get comfortably through an average stretch of calm, cloudy weather. Usually, this is in the range of 30,000 to 80,000 watt hours, or more, depending on the size of the house and the appliances in use. The batteries available range from the small, deep-cycle, golf-cart style batteries with a 5 to 7-year life expectancy, to top-of-the-line batteries weighing several hundred pounds and boasting a productive life of 15 to 25 years. For convenience, wall-mounted meters are commonly used to let you know (as a percentage) how much power you have stored in your batteries at any given time.

***Power Inverters***

Power inverters are true wonders of electronic engineering. They are designed to take low voltage DC (12, 24 or 48 volts, depending on the system design) and convert it into usable 120 volts AC, pulsing at 60 hertz. Ordinary house current, in other words. Large inverters can operate continuously at nearly 50 amps, which is enough power to run a table saw, a dishwasher, a 1½ hp well pump and a clothes washer, simultaneously.

To run 240 volts loads, such as the above mentioned well pump, a 120 – 240 volt transformer can be installed, or multiple inverters can be “stacked” to provide higher voltage and/or amperage.

These, then, are the basic components of a renewable energy system.  Though the technology behind them is state-of-the-art, the concepts they put into practice are quite simple. The question that remains is: how does it all relate to your remote log home?

**Renewable Energy and Log Homes**

Anyone who has ever lived for a year or more in a tightly-constructed log home finds it exceedingly hard to believe that logs have been determined to have a relatively low R-value. How could a house that stays so snugly warm through a winter’s night and so cool through a sizzling summer day have a low resistance to the passage of heat?

There are several factors that, taken together, account for the disparity between laboratory results, and what is observed in the real world. The first thing to consider is the nature of the much-touted R-value, which is simply a material’s inherent resistance to the passage of heat under strictly controlled laboratory conditions. It is determined by placing the material between a heat source and a heat sensor and measuring the amount of heat that passes through the material over time. For lightweight materials that cannot store large amounts of heat, it’s a fairly good way to predict how well the materials will perform when used as part of a building. But for massive materials, such as logs, the standard methodology becomes misleading.

Why? Because such methods do not take into account logs' tremendous ability to absorb heat over time, then to radiate it back later, as the ambient temperature drops. Consider, for example, what happens on a winter's night when the mercury begins to plummet after sunset. During the evening hours the thermostat is turned up, or the wood stove is stoked, and the log walls are absorbing this heat like a sponge soaks up water. Then comes bedtime. You turn down the thermostat, or throw another log on the fire just to keep the embers burning, but in either case the output of your heating sources will diminish during the night.

If you lived in a home with conventional lightweight frame walls, there would be very little heat stored within them because there would be a relatively small thermal mass. The heat provided by the furnace or the wood stove would eventually pass through the walls, or around windows and doors to the outside, leaving you in the cold.

Your log walls, in contrast, have been soaking up heat all through the day and evening, and are more than happy to give this heat back at night, when it's needed most. When you get up in the morning the house will be warmer than a frame house and require less energy to bring it back to a comfortable temperature.

This situation is reversed in the summer, when the outside temperature exceeds indoor comfort levels. Your log walls will store heat from the outside during the day and radiate it back to the great outdoors at night. By the time outside heat traveling through the walls reaches the inside, the sun has set, the windows are open, and the heat naturally travels back out again on convective air currents. When you awake in the morning your walls are again cool and ready to protect you from another hot day.

The bottom line is this: under most circumstances, the inherently low R-value of logs is more than compensated for by their ability to store large quantities of heat, which is then radiated back when the ambient temperature drops. For log homes, it means that temperature swings inside the structure will be noticeably diminished, compared to a frame house of comparable design.

For those of you dreaming of building a log home on a remote site, this is indeed good news. Any modern central heating system you choose will require some amount of electricity to operate, even though the fuel will be propane, natural gas, or fuel oil. Forced air heating systems need electric fans, while hot water heating systems—which can be made considerably more efficient by augmentation with solar-heated water—use a series of electric pumps to circulate water. Any structure that lessens the overall amount of time the pumps or fans need to run will save precious homegrown energy. Likewise, a structure in which the duration of each heating cycle is reduced will give the home's solar and wind system more time to replenish its reserves between cycles.

Home scale solar and wind energy systems have finally come of age. As the cost of the components has dropped, their reliability and sophistication has increased dramatically. How ironic it is, then, that the time-honored craft of log building should prove to be among the most efficient applications for this space age technology.

Those of us who live in remote log homes, of course, knew it all along.