AC vs. Solar Power: Choosing the Right Safety Sign

By Jack Rubinger · February 2006

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"**YOUR** Speed" driver feedback signs have become increasingly popular devices for slowing traffic and increasing workers' safety. Thanks to new technologies, these signs have become more effective and easier to deploy than ever before. For instance, improvements in sign designs that make it easier to use solar technology now make it possible to set up and use electronic signs in places where they were once impossible or impractical.

In fact, solar-powered signs are now used in many places that aren't typically considered solar-power-friendly.

"Even here in Alaska, where we receive long periods of sunshine and darkness depending on the season, our solar panel signs combined with battery back-up power are used year-round," said Michael Cobbold, safety manager and sustainability coordinator for Denali National Park & Preserve in Alaska. "Our calculations showed that the technology we needed to employ solar power was still more cost effective than it would have been to actually run a hard-wired connection to AC power."

But there are several issues that must be considered in order to choose the right equipment. Your specific application, the environment and location where the sign is to be used, and specific sign features all play a role in selecting the best setup.

Is Solar the Right Choice?
The first thing you must decide is whether AC or solar-powered signs make the most sense for your particular situation. Conservation issues aside, the choice typically comes down to two concerns: cost and flexibility.

Solar-powered signs offer increased flexibility that plug-in signs simply can't. Often, signs are needed in locations where hard-wired power sources are not readily available. In these cases, pure battery-operated signs are one alternative, but these require constant recharging--at least every week--and this can be both costly and resource-intensive. Also, overall battery life in these types of applications is typically short, so ongoing sign maintenance becomes a consideration.

On the other hand, solar-powered signs can provide years of virtually maintenance- free service. They can easily be installed along roadways, loading docks, remote construction sites, and other locations where access to AC power is limited but cars and motorized equipment affect overall worker safety. What about the cost? Whether connected to AC or powered by the sun, driver feedback signs consume very little power: on average, about as much as a night light. But while the energy cost of operating these signs is negligible, the difference in installation costs can be dramatic. Even when power is available nearby, it may be necessary to tear up roads, sidewalks, and landscapes in order to run the wiring necessary for your AC connection. An AC hook-up also may require you to install a meter to measure the amount of energy you use. Ask the utility company whether it can bill you a flat rate for your energy use instead. This will save you the cost of the meter and will reduce the overall cost of installation. Your local utility company can tell you the specific requirements for your installation. Once you have this information, your contractor can give you an estimate for your overall construction costs. Of course, with solar power, you do not have to be concerned with meters or power runs.

Once you have construction estimates for AC power installation, it is time to determine the cost of your solar power needs. By comparing the two, you can make an informed decision regarding the right choice.

"Customers often assume that AC power is less expensive than solar," said Gary O'Dell, president of Information Display Co. of Beaverton, Ore. "Once you factor in all the costs of getting AC power to the sign, you may be surprised to find that you could ultimately save by going solar."

There are several things to consider when determining the cost of solar power. To begin with, you must ensure you have the right equipment for your specific application. This is a matter of analyzing information concerning two things: the amount of power you will need and the amount of available sunlight.

Other Selection Criteria
All electronic signs are not created equal. Differing design features and functionality can have a significant impact on the amount of energy a sign draws. The more energy the sign requires to operate, the bigger solar panel you'll need.

For instance, some warning signs are made to focus light only where it is needed. Besides the advantage of preventing the distraction of other drivers, the focused viewing means less light is wasted and so less power is used to achieve the same light intensity. High-end contrast enhancement technology also can reduce power requirements by providing a very dark background that permits excellent visibility with lower light output. Advanced glare management techniques can further improve the contrast ratio, which again makes them easier to see at lower light output.

"Step one is finding out the amount of energy your sign requires to operate. Design features and the efficiency of individual components can make the difference between a sign that draws 10 watts of power and one that draws 100 watts, and that can have a huge impact on the size or number of solar panels you'll need," said O'Dell.

Next, consider your specific application. The percentage of time the sign is illuminated will have a large effect on overall power consumption. Using the sign in an area of high traffic flow will cause it to draw more power than in areas with occasional traffic. Similarly, signs used around the clock will require more power than those that utilize a timer to operate only during school hours or commute times.

Most significantly, you must determine the amount of sunlight that will be available, which is often referred to as units of solar irradiance or solar kilowatt-hours per square meter (kwh/m2). Because your solar-powered sign will rely entirely on the sun for its energy source, it is critical that this information be accurate.

How Much Sunlight is Available?
The most common mistake made when calculating solar irradiance is that many companies use data that is based upon solar radiation averaged over many years. This may be fine for large solar-powered installations that include backup generators or power grid connections. Because electronic signs rely solely on the sun for power, however, it is important that the device gets enough energy from the sun even during the most cloudy and miserable days of the year. Your calculations must therefore be based on worse-case scenarios rather than averaged data.

"The difference between averaged and worse-case scenario data can be very significant," said O'Dell. "For instance, the commonly used average solar irradiance data for Fresno, California, shows a 'low' of 3.42 Sun Hours, but more accurate historical data shows that in December and January, Fresno actually receives an average of 2.4 Sun Hours. More importantly, there are December days in the region when the sun provides less than 1.7 Sun Hours--half the amount of sunlight that the averaged data indicates. A system designed around the assumption of 3.42 Sun Hours will fail during the winter months."

O'Dell said the most reliable data regarding worse-case weather conditions is provided by the U.S. Department of Energy in its 30 year Incident Solar Radiation Charts. (You can view these data at http://rredc.nrel.gov/solar, a site from DOE's Renewable Resource Data Center.) Be sure your provider is using this information to determine the proper size for a solar panel. It's also important to consider the specific environment where the sign is to be used. Large overhanging trees, roofs or other obstructions can play a major role in the size and number of solar panels that will be required.

Using the correct data also will have an impact on battery life. Virtually all solar-powered systems include a battery backup. A system that is undersized will require the battery to run for extended periods at less than full charge, and this will dramatically reduce battery life.

Battery size is yet another factor in system longevity. A battery that is drained more completely before each recharge will have a much shorter lifespan than one that is used only a little. For instance, a backup battery that is completely discharged each night will typically have a lifespan of approximately 300 cycles and would need to be replaced in less than a year's time. A much larger battery would cost only a fraction more relative to the cost of the whole system, but a battery sized so that it is discharged only 10 percent every night will last closer to 3,600 cycles--potentially 10 years or more.

Calculating Total Costs
Now that you understand the data required to make an accurate calculation, it is possible to determine and compare the total cost of solar vs. systems using AC power. Gather the information you've collected: traffic conditions, length and time of intended operations, regional solar data, and local conditions. Share them with one or two sign dealers. Remember, resulting costs can differ dramatically depending upon the efficiency of the dealer's products and the use of proper data.

Using this process, the Ripon Police Department in Ripon, Calif., was able to calculate the overall cost of solar power vs. AC-powered signs quickly and easily.

"We currently have four solar-powered radar display signs located in our city," said Sgt. Ed Ormonde of the department. "They are used year-round and indicate the speed of passing motor vehicles with a flash when the present speed limit is exceeded.

"We decided on solar panel signs because we felt they gave us the flexibility to place them in areas where AC power wasn't appropriate," Ormonde added. "Additionally, AC signs would have required the city to lay down conduit and wiring-- further complicating the installation. Using the right data gave us the information we needed to install a system that we can confidently use cost-effectively and operate every day of the year, rain or shine."

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