Solar Billboard Lighting Done Right:
a 12 Step Program

1500W unitized solar system powers a billboard lighting system in South Texas, reliably, year round.

Solar billboard lighting has been around for 30 years, but it's only recently, with the development of high efficiency LED lamps, have solar billboards matched the light levels of line powered boards.

Unfortunately, that doesn't mean you will find a reliable solar system and compatible lights that will last the life of the board.

A poorly designed or sized solar system can impose an untenable burden in terms of frequent service calls, high maintenance expenses and excessive replacement costs. On the other hand, a well-designed solar system will provide many years of trouble free service. Before you spend your hard earned money, I'd like to share a few guidelines I've learned over the last 30 years, building high reliability, remote solar power systems.

Please consider my 12 step program for success...

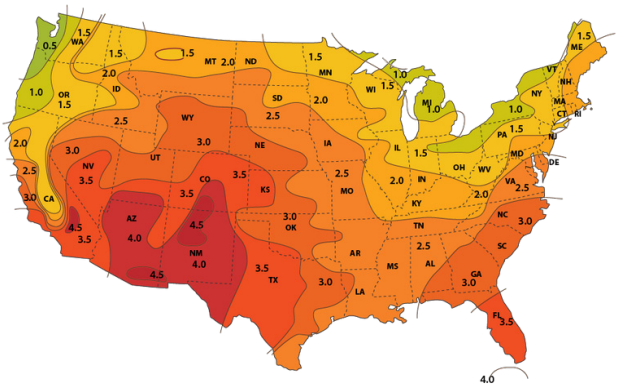
1. FIRST AND FOREMOST, IT'S ALL ABOUT THE LIGHTS

Skimp here and you're wasting your time. Use only high quality, brand names you can trust.

They may pull more power, but that's because they're brighter and have better optics than the inexpensive brands.

They may cost more, but it's because they're built to last. LED's are touted as lasting 100,000 hours. But that's only true if the light around it and the driver powering it are also built to last 100,000 hours. (at 6 hours per night, that's 45 years)

High quality cast aluminum fixture and precision optics assure long life, even illumination, and customer satisfaction.



Solar lighting systems should always be designed for worst case winter sunlight levels, never average annual sunlight. (Map courtesy NREL)

2. USE REALISTIC WINTER WEATHER DATA

If you use average sun sunlight, (peak sun hours) instead of winter sun hours, your system will fail frequently during an average winter, and repeatedly during a bad winter. Your revenue depends on reliability, and reliability starts with a properly sized solar system. Frequent failures also dramatically reduce the life of the batteries, requiring frequent, and expensive, replacement.

3. DON'T SKIMP ON BATTERIES

Only the southwest desert areas of the US can get by with 5 days of reserve, everywhere else should have at least a week, preferably 9 – 10 days. Yes, they cost more, but they double the reliability of the system and the life of the batteries. Batteries should last a minimum of 5 years, and a properly sized wet battery bank should last 10 years, even in hot climates.

A large battery bank assures reliable operation during cloudy winter months. 50KWH, maintenance free system shown, in an insulated vented enclosure protected on all 4 sides by tamperproof sun shades.

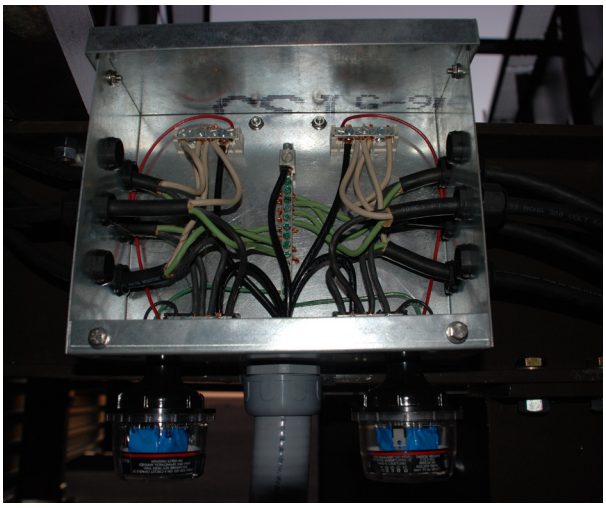
Batteries are completely protected from the elements, in this desert location, both human and natural.

4. AND PROTECT THEM

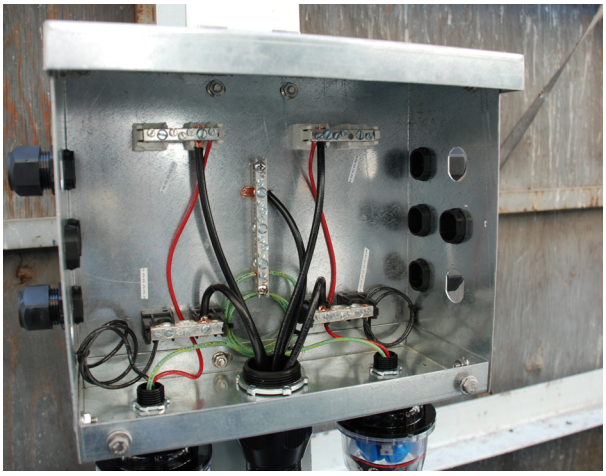
Protect your batteries from the elements, both natural and human. Sun shades protect not only from sunlight, but wind, snow, driving rain and other weather extremes, as well as from prying eyes. Avoid plastic battery boxes or control enclosures, they are prone to cracking and degradation in sunlight, and generally overheat the batteries, shortening their life considerably. They are also harder to secure, and are prone to cracking from the stress of larger conduit.

5. USE A LIGHTING COMBINER BOX

Use a lighting combiner box to avoid wiring errors and facilitate trouble-shooting. DC lights can't be wired like high voltage AC lights, and a junction or combiner box is simple to understand and provides a central access. Protect your lights and electronics with a pair of high quality surge arrestors, one for each side of the board, in the junction box.



24VDC lights are wired differently than AC lights, and most electricians are not familiar with DC wiring practices. The lighting combiner box assures a quick, correct installation. Large surge protectors, one for each side of the sign, are mounted below.



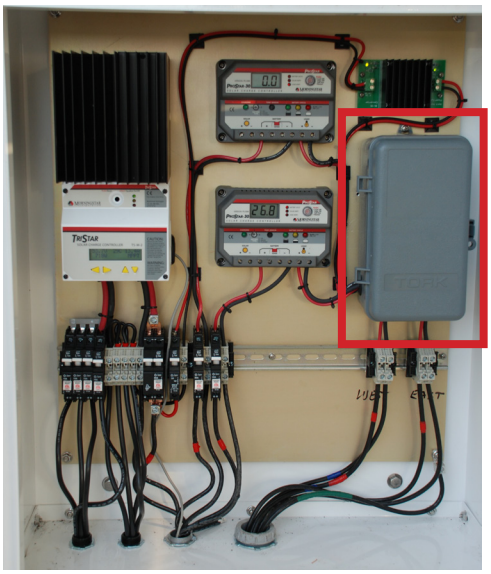
AWG#6 wire is used from the controls to the light combiner box, AWG#10 is then run to the lights to prevent excessive voltage drop.

6. WITH HEAVY GAUGE WIRES

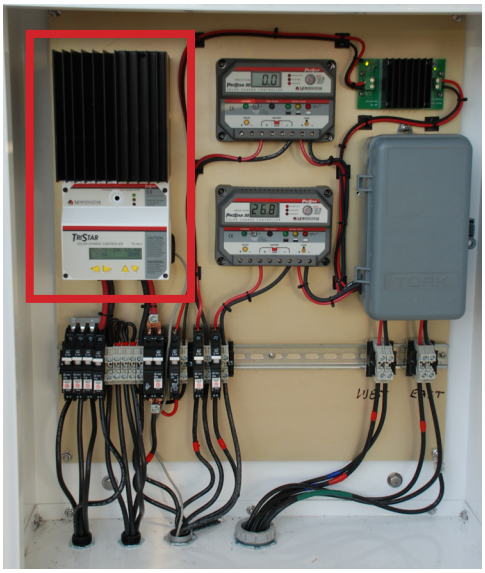
Use heavy gauge wires and larger conduit than you're used to using. Most DC lights are 24VDC, and given the longest wire run from the ground to the farthest lights, AWG#6 is required up the pole, and AWG#10 to each light from a central combiner box. This prevents excess voltage drop, meaning brighter lights.

7. CHOOSE YOUR TIMER CAREFULLY

Choose your timer or controller carefully Without the 60HZ that usually keeps a timer accurate, DC systems typically require a DC/DC converter to provide clean, regulated power to the timer or remote control that controls the lighting schedule. Again, it's a good idea to protect the timer and solar controls with another high quality surge arrestor in the control enclosure.



TORK astronomical timer, grey box on the right, is used to control the lights each side of the board separately



Solar MPPT controller is shown, upper left, individual load controllers for each face are shown center, DC/DC converter upper right provides clean power to the TORK timer.

8. DON'T USE OUTDATED SOLAR TECHNOLOGY

The best systems use standard, large area solar modules combined with Maximum Power Point Tracking (MPPT) battery charging, for highest solar system efficiency, and long term assurance replacement solar modules will be available. These solar modules all have very similar dimensions and electrical characteristics, regardless of manufacturer, and an MPPT charger is 10-15% more efficient than the older PWM chargers.

9. DESIGN FOR LONG LIFE

Durable materials such as hot dipped galvanized steel, powder coated aluminum battery and control enclosures, stainless steel fasteners and bronze grounding lugs. A well designed solar power system should last a minimum of 30 years with little degradation. The solar system should be designed to outlast the sign it's powering.

A good example of how not to build a solar power system.

Same sign, with a new solar system designed to last.

10. PROTECT YOUR ASSETS

Tamperproof fasteners to create multiple barriers to entry. Padlocks are now vulnerable to cordless grinders and can be cut in seconds. Use round, solid padlocks encircled in steel, and tamperproof fasteners with security rings to deter theft. SmartLink systems can also be equipped with security features for monitoring and protecting remote systems.

Hardened stainless steel tamperproof fasteners protect your assets. Multiple points of protection discourage most thieves.

11. CONSIDER WEATHER

Consider weather extremes, especially the wind loading on solar modules during a hurricane. Most of the sunnier parts of the US are also subject to occasional high winds and gusts, and will see them many times over the 30 year life of the system.

Coastal solar systems should be designed for 120MPH winds, inland 100MPH

Two examples of well designed, professionally installed systems. The top system features a unitized solar power system, while the lower system features the solar array on top the board.

12. YOUR REPUTATION IS ON THE LINE

A poorly designed or sized solar system can burden you with frequent service calls, high maintenance and excessive replacement costs. Even worse, you've ticked off a customer and probably ruined your chances of deploying future solar systems.

Remember, a well-designed solar system, combined with quality lights, will provide many years of trouble free service.

In conclusion, do your homework, check references, and don't believe everything you want to hear!

GLOSSARY OF UNFAMILIAR TERMS

PEAK SUN HOURS — this is a standard measurement for the amount of sunlight a particular region gets, month by month. These values are based on 30 years of historical weather data.

A peak sun hour is defined as 1000W per square meter, at 25C and a 1.5 air mass. A region that gets 3 peak sun hours in winter, like Houston, for example, gets the equivalent of 3000 watts of sunlight over the course of the entire day

SYSTEM EFFICIENCY — is the sum of all the electrical losses in a solar system. Battery charging efficiency is 80%, for starters, with control and wire losses usually another 10%, so at best, a solar lighting system will only be 70% efficient.

This means in a 3.0 peak sun hour area, your daily solar harvest and conversion is only 2.1 peak sun hours.

SAFETY FACTOR — this is accomplished by oversizing the solar array and increases the system reliability.

AUTONOMY — or battery reserve, the number of days a system will run with no solar input, such as an extended cloudy and rainy period. In cold climates battery capacity should be de-rated for cold temps below 40F.

ABOUT THE AUTHOR

Kevin Conlin is a 30 year veteran of the solar industry, building high reliability remote power systems for military, telecomand, oil & gas applications.

His company, Autonomous Power Solutions, has developed the Work Horse line of solar lighting systems for the outdoor advertising industry.

WORK HORSE POWER SYSTEMS

AUTONOMOUS POWER SOLUTIONS