Maintenance and Long Term Costs of a Solar Beacon System

by Joseph Wise

Many times, when I have been at final check and activation for the flashing beacon systems we design and manufacture, a representative from the agency in charge steps forward looking a little concerned and asks, “How do we maintain the equipment and what will it cost us to operate it?”

When properly designed, solar power systems are simple and reliable. They will not require a great deal of time or cost to maintain.

A typical solar flashing beacon system includes (1) a solar array comprising a solar module which converts the sunlight to DC electricity; the mounting structure to hold the solar module and attach it to the pole; and the array output harness. (2) The system controls panel which consists of a charge regulator, flasher circuitry and, in a school zone system, a programmable timing device. (3) The battery for storing energy; most systems will consist of one to four batteries. (4) An enclosure which holds the electronic controls and batteries. (5) The LED lamp assemblies.

From a maintenance perspective, solar flashing beacon systems require little upkeep during their operating life. Solar modules have become a commodity item. Very often the warranty may be the only distinguishing benefit among competing brands. Most manufacturers offer a 20-year warranty on power output. There are no moving parts to warrant and electrical failures within the solar module generally show up early.

Installation of 3M DFB sign in Glendale, Arizona

Maintenance for solar modules is generally confined to shading from surrounding plants and accumulations of dirt or bird droppings on the modules. Modules installed at a tilt are usually washed clean of dirt and droppings by periodic rains. If a large bird, such as a hawk, uses your solar array as a convenient perch, you may need to periodically

wash the droppings off the solar module.

Remember to check for shading from nearby trees, shrubs and buildings that may impact your solar power output. The best time to inspect your modules is between 10 a.m. and 2 p.m. when the majority of the day's charging takes place. Trees and shrubs may need to be trimmed periodically to prevent shade-related problems. Loss of even a half of a cell in polycrystalline or crystalline solar modules can cause significant power loss, and is easily prevented.

Electronic controls have become more reliable over the years yet issues arise which require maintenance. The most common is damage from lightning-related events; another could be failure of the timing device. Lightning strikes are unpredictable. We have seen entire control panels destroyed or a single lamp drive transistor fail. Agencies should plan to keep a spare control panel on hand if they have multiple systems. Regular maintenance should consist of checking connections to ensure they are clean and tight. Also check the timing device for time drift and that the system functions manually in the event of a time clock failure.

The system battery is the one component that will wear out and need regular replacement. Most manufacturers use only sealed, lead-acid batteries for flashing beacon systems. The all-important reasons: they're maintenance free so technicians need not add water periodically and there are no fumes or acid-related corrosion issues. These batteries cost substantially more yet appreciably reduce maintenance during the life of the system.

The most common types of batteries are the gel and AGM (Absorbed Glass Mat). Battery life is subject to a number of factors. The three most critical things to consider are the average daily depth of discharge, the charging method and the temperatures to which the batteries are exposed. We have known gel batteries to last as long as seven years in cooler climates and as briefly as five years in hot climates. AGM batteries have shown a similar life span. It is safe to say the life of the system battery in a properly designed system should be on the order of five to seven years.

The cost to replace a sealed battery can be from $120 to $160 depending on its capacity. Since the actual battery life varies with environmental conditions, it is recommended that the flashing beacon systems be put on a preventive maintenance schedule and batteries replaced around the five-year mark. Some battery manufacturers can test batteries at their local distributors and provide you with an estimate of the life remaining in a battery.

LED lamps have become less expensive over the years and have replaced incandescent light sources for most solar beacon systems. Individual LED elements have a rated life of 100,000 hours which translates to more than 11 years of

continuous, reliable operation. Most DC lamps use a simple regulator circuit to maintain the optical output of the lamps. Consequently they do not experience the failure rates for their circuitry as with the far more complex AC lamps.

Because of their reliability, most LED lamps on the market include lengthy warranties: some up to five years. We have had only two DC LED lamps fail during the past four years—a small sample compared to the several hundred we ship every year. Aside from an occasional cleaning of the lens the LED lamp does not present a significant maintenance issue in the beacon system.

Most school zone systems include a single battery which may cost from $120 to $160 to replace once every four to seven years. Most AC powered systems will have their own meter which has a base monthly charge to operate of approximately $10 to $13. This means that the cost for powering the AC system during the same period will be on the order of $480-$1090.

The primary reason for choosing solar power over a grid-connected AC system is the initial cost. If the total cost of providing an AC power connection to a site is more than $2,500, solar may be a viable option. When weighing your options ensure that all the initial and life cycle costs are considered including recurring costs, such as AC power service.

When all costs are considered, a well-designed solar-powered, flashing beacon system provides an affordable option for the projected life of the system with a minimum of time and cost for maintenance.

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