Introduction

Road authorities needing to install traditional flashing signals for hazards have to factor in the cost of bringing utility power to the site as well as paying the minimum yearly operating cost for the power. Often, the cost of getting the power to the site is alone deemed prohibitively expensive, thus leaving potentially dangerous stretches of road without proper hazard warning.

With improvements in low power lighting technology, in particular LED, remote signals can now provide their own power on site, typically through solar/battery system making them a convenient and less expensive option. However, although these systems have been in use for more than a decade and are well proven, there are still certain factors that need to be considered before choosing and installing a system. These include:

- Sunlight: sufficient year-round exposure to ensure system functions to specification.
- Battery: capacity appropriate to provide power to load in worst-case conditions, e.g. winter.
- Performance: according to industry standards for application.
- Life span: justify initial investment.

Improvements in wireless technology with solar power has also had an effect in that many signals can be triggered by remote saving not only the cost of powering the signals/triggering device but also the cost of the cable run between them.

The Systems

Currently, there are two basic types of systems used in solar-powered road signals/flashers:

All-in-One (Compact) systems integrate the photovoltaic (solar component) cells, control electronics and batteries in/on the signal housing.

Scalable systems are designed with the photovoltaic component and the battery/control enclosure apart from the actual signal housing. This allows for appropriate solar or battery capacity to be added prior or after installation to match the site environment.

Both types of systems have their advantages and disadvantages.

System Advantages/Disadvantages

All-in-One (Compact) Systems

Advantages
- Typically easy to install as everything is found on the signal housing. Some have adjustable settings on the control electronics, but physical installation is quick and straightforward.
- Small and discreet.

Disadvantages
- Has relatively small solar panels and batteries. Unable to fully meet industry standards for light intensity (ref. ITE Sept. 2004, MUTCD).
- Control electronics can/will alter the signal light intensity or flash rate/duration to compensate for inadequate battery capacity.
- Photovoltaic cells (solar) are typically situated in a fixed position on the signal head resulting in a greater potential for unacceptable levels of shading from poles, trees, improper tilt, etc. Drastically affects the ability to recharge battery.
- Repairs require entire system be removed for service by the manufacturer or replaced.
- Average warranty is three years on entire system.

Scalable Systems

Advantages
- Solar and battery components can be sized to load and site conditions resulting in signals that fully meet ITE/MUTCD signal photometric specifications.
- Solar panel can be installed in an optimal location to avoid shading by poles, trees, etc.
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- Repairs are typically done on site often through diagnostics and replacement of component.
- Manufacturers’ warranties on system components are usually generous, e.g. 25 years on solar panels.

Disadvantages
- Requires greater effort to install with three components (solar, battery enclosure and signal) to mount and interconnect.
- Solar / Battery / control component(s) are less discreet.

Summary
Since the initial investment in either of these systems is similar, choosing which is most appropriate for the task will depend on its adherence to ITE/MUTCD visibility standards. If a road authority is obliged to use the ITE standard to fully comply with signal visibility standards, a scalable system is required. If the authority is not bound by these safety standards for its application/site, either system may be considered.

Some key environmental factors that are to be considered when considering an installation using solar (photovoltaics) as a power source;
- The farther your site is from the equator, the more likely the solar/battery capacity will have to be sized to winter sunlight levels.
- Those sites that have freezing temperatures should have the appropriate batteries for that environment.
- Trees, buildings and mountains all have the ability to affect the ability of the solar component to provide sufficient power for the system to operate.

What these factors make obvious is that in order to assure year-round operation of these types of systems the components should be designed and sized for the worst case environmental conditions anticipated at the site.

The flexibility in site location, autonomy from the utility grid (blackouts) as well as substantial cost savings from eliminating trenching/poling for utility power provide transportation authorities with a powerful tool while keeping operational budgets under control while providing hazard indication in areas that otherwise would have been left without appropriate warning.

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