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Solar-Powered Fire Station Exit Lamp Systems gain in acceptance and functionality while maintaining affordability

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When I founded Solar Traffic Controls in 2001, I was aware of the potential for solar-powered warning beacon systems for fire station exits. It was a small percentage of our business and remained so for years. It seemed there were two schools of thought. The first was to use advance flashers which ran 24/7 or for a short duration when activated from within the station, with a W11-8 sign on each approach to the station driveway. The second was to use a full three-section signal assembly on a mast arm over the roadway. Depending on what state you were in the signal would be configured as an RYG, with green displayed in standby, or Red-Yellow-Flashing Yellow (RYFY) with the flashing yellow displayed in standby. Both types of systems were tied to AC power.

There were few solar options in those days and those available seemed unreliable or overly expensive. I can recall one manufacturer from Florida which offered a solar-powered package. An Arizona agency asked STC to examine a non-functional unit from this vendor to determine if it could be fixed. We knew from prior experience this vendor's equipment was quite expensive so we were curious about its components.

As it turned out the controls consisted of such a complex set of circuit boards it was impractical to field repair. Subsequently, we ran into a number of fire departments with similar equipment from the same manufacturer. They, too, had given up on their systems due to the complexity and costs of repairs. I saw three signals at a fire station in the Phoenix metro area that were simply falling apart since the FD had given up on them. They eventually disappeared as did the manufacturer of the equipment.

Another problem early-stage systems had were the one-size-fits-all mentality for the solar and the battery. We found most manufacturers typically offered little range in the power systems. While we're not aware of any specific issues, this practice could have led to wintertime operational issues if the power systems had been sized improperly for northern latitudes such as Chicago or Detroit where winter sunlight levels are low. Regardless of which manufacturer agencies had experience with, we generally found most of them were skeptical of solar due to previous negative experiences.

In the last few years, sales of fire station beacon systems have become a significant percentage of STC's business as is true for some of our competitors. What has changed? The two primary factors seem to be reliability and cost. As solar has become a more widely applied technology, it is easier to find purveyor's of the technology who are familiar with the three rules which dominate solar: Location (solar resources); Load (what draws power in your system and how much); and Duty Cycle (how long each load pulls power each day, on average).

Understanding the abundance or limitations of solar power within regions of the country has a tremendous influence in both the size and cost of the power system needed to provide reliable year-round operation of the equipment. Reliable solar data from agencies such as the National Renewable Energy Labs (NREL) provide an unbiased glimpse into what one can expect for solar data, on average, throughout the year in a particular area. NREL makes such data available to the public for use in various solar design programs. Adherence to standard practice in the design of the solar power system eliminates downtime even in the worst winters in most locations around the country.

Equipment used in the systems (Loads) has also become more reliable with the widespread acceptance and use of LED lamps as beacons. Radios and control logic have improved and decreased significantly in price, while increasing in variety. Battery life has improved with many sealed solar batteries offering anywhere from 5-8 years of reliable operation, again subject to proper overall system design.

The cost factor comes into play when one begins to compare the installation of today's more reliable and more varied solar-powered equipment against installation of traditional hardwired AC systems. In general when one looks at the cost of a solar-powered system it appears greater than the same package of AC-powered equipment.

However, many agencies are now looking at the AC infrastructure costs and the time costs associated with installation of an AC system as part of the overall project costs. Site-specific issues may require boring under the road to install conduit or trenching by hand for conduit due to crowded right-of-way conditions along many arterials. In some cases these issues alone can drive hard-wired AC project costs beyond original budget estimates. Now that solar-powered beacons systems have become more widely accepted, what options do agencies have? The Manual on Uniform Traffic Control Devices (MUTCD) has a whole section dedicated to the rules which apply to these types of signals. This year the MUTCD will be revised to include a number of new emergency vehicle signal system designs some of which have specifically been approved with the idea of using solar.

I suggest a quick search on the internet will reveal that there are quite a few possibilities. To be fair to STC's competitors I am going to encourage any agency considering solar-powered fire station beacons to look online to review all of the possibilities before selecting a vendor to work with. For specific examples, I can illustrate some of the equipment that STC has fielded which has been accepted by a number of agencies across the country.

Activation/Detection Equipment
This is typically the last thing customers think about when they request a system but it should be the first since the lights start running when you hit the activator.

Handheld transmitters
Handhelds are great; they can be mounted almost anywhere in the cab of the vehicle. On the flip side, they can disappear quickly if they move around a lot. Figure 1 shows some typical handhelds. Remember: the ones with the external antennas typically have a longer range and are harder to lose since they stick out.

Figure 1, typical handheld radio transmitter devices.

Wall mount transmitters
Wall mount transmitters are great for the bay in the fire station. If you select one, make sure it is expandable to allow remote buttons to connect to it. This allows you to have buttons in various areas or even to connect to your bump out system. Figure 2 shows a typical wall mount transmitter complete with red mushroom switch.

Figure 2, typical wall mount radio transmitter unit with roof-mounted antenna.

Optical detector with radio link
Pre-emption systems are very popular and can be incorporated into the activation scheme. Figure 3 shows a typical optical detection unit which senses trucks going on call via their pre-emption emitter signal. When the signal is detected the unit radios down the street to the flashing beacon systems to activate them. Feedback is provided by the supplementary 2.5-inch LED confirmation lamp looking up the driveway with the detector.

Figure 3, optical detector unit with radio transmitter located to look up the station driveway.

The basics of flashing warning beacons
The most basic warning beacon configuration is a single 8-inch amber lamp over a W11-8 sign. The signal presents a dark face to oncoming traffic until it is activated to run for a preprogrammed time. From this you can vary it by adding one or two more lamps to the beacon or increasing the size to 12-inches for greater visibility. You need at least one lamp forward, two is typical and the third lamp can face back to the station driveway as a confirmation lamp. One option that seems to be more popular is a clear omni-directional strobe mounted to the top of the solar array near the antenna. Figure 4 shows a typical system with the confirmation strobe. Remember: these can be configured for installation on mast arms as well as type A-poles.

Figure 4, typical dual lamp flashing beacon systems. Right unit features the clear confirmation strobe.

Exit signal systems
These tend to be the top-of-the-line for solar fire station warning beacon systems. Credit for development and inclusion of this signal format in the MUTCD really has to be given to the City of Tucson traffic engineering group.

These systems feature a "Mickey Mouse" signal pattern which features 2 red lamps on top (the ears) and an amber lamp on the bottom (the head). The signal presents a dark face to approaching traffic. When activated the lamp warns motorists by starting with a flashing yellow interval, minimum of 3 seconds, which is based on the average speed on the street. It is then followed by a solid yellow interval, duration again determined by the typical speeds on the street, but no less than 3 seconds. This is followed by a wig-wag flashing red display on the lamps, the duration of which is determined by the traffic engineer and the fire chief.

This system can be retriggered in the red mode meaning you can extend the red flash interval for multiple trucks to leave the station. These systems typically feature a clear confirmation strobe that functions only during the red interval. Figures 5 and 6 show typical crossing signal systems. It should be noted that the crossing signal systems can be operated as slaves from the various transmitters discussed above or they can be configured as master-slave pairs. In a master-slave pair the master is typically configured with an optical detector to drive the two signals.

Figure 5, City of Tucson fire station exit signal with "Mickey Mouse" signal head.

Figure 6, fire station exit signal system City of South Tucson.

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