FLORIDA SOLAR ENERGY CENTER®

Photovoltaic-Powered Lighting System for Overhead Highway Guide Signs

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Fact Sheet

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The problem

A safety hazard affected motorists traveling through a remote area in Brevard County near the St. Johns River on the eastbound Bee Line Expressway (S.R. 528). At that point the Bee Line splits, sending Titusville- bound motorists to the north, and Central Brevard- bound travelers to the south. Because of the high cost of extending utility service several miles from the nearest distribution point, the overhead guide signs were not illuminated, and at such a critical juncture on the 65-mph highway, it was difficult, if not impossible, to read them at night.

The problem-solvers

Since 2.5 million vehicles per year travel the Bee Line's north and south arteries from the Orlando area, the problem was critical. Therefore, in July of 1987, under the sponsorship of the Florida Department of Transportation and the Florida Governor's Energy Office, the Florida Solar Energy Center (FSEC) undertook to design, install and monitor the performance of a prototype photovoltaic-powered lighting system for overhead guide signs.

The solution

Photovoltaics, the technology of converting sunlight to direct-current electricity, was the method of choice because it has been shown to be a viable option for many remote and atypical electric power systems.

Work began by conducting an extensive literature search on similar applications and pertinent Federal Highway Administration and American Association of State Highway Transportation Officials standards and regulations. Photometric and electrical characteristics for a wide variety of lamps and fixtures were evaluated to identify the most efficient combination that would meet the illumination requirements. This was necessary to minimize the size of the photovoltaic system needed to power the lighting system.

System design details and installation were completed in May 1988. The photovoltaic system is expected to provide continuous service for 20 to 30 years with minimal maintenance. Designed and installed by the Florida Solar Energy Center with assistance from the Florida Department of Transportation, the project satisfies a real need both in economic terms and in the interest of public safety.

The system description

The system consists of a 1.2 kWp photovoltaic array that charges a 24-volt dc, 1200-ampere-hour battery bank. The array is mounted on top of the guide sign truss structure to reduce potential damage and to receive maximum exposure to sunlight. The mechanical attachment is designed for integrity in hurricane force winds. Lightning protection is provided on the arrays to reduce the risk of damage to control system components.

The lighting system consists of 30,000-hour fluorescent lamps enclosed in luminaires with mylar parabolic reflectors. The lamps are operated by high frequency 24-volt dc solid-state ballasts to further improve the performance of the lighting system. Each of the two 12' x 18'signs are illuminated by three luminaires. The design incorporates an innovative control strategy that extends the battery storage capacity and ensures system operation for a week or more with no sunlight. The center lights on each sign are automatically disconnected at 50 percent battery state-of-charge while the remaining outer lights provide adequate illumination. A data acquisition system is also installed at the site to monitor operational parameters such as battery voltage, photovoltaic output and lighting system performance.

The conclusions

This application of solar technology represents a cost-effective alternative and provides a much needed function to ensure motorist safety. As photovoltaic system technology continues to mature through research and development and as electric energy costs continue to rise, more and more applications will be identified, with the solar solution as the optimal solution.