Pro-Life Sign on Geci Farm with Solar Lighting

D. L. Meier

October 31, 2013

A solar lighting system for the Elk County Right to Life sign on the Geci farm was completed on October 28, 2013. The purpose is to extend the time the sign can be viewed by motorists traveling on the Million Dollar Highway from daylight hours into the night. Currently, the lighting is energized for six hours following dusk and for two hour preceding dawn. A photograph of the south-facing side of the system is shown in Figure 1. A roof structure was fabricated and attached to the free-standing sign at its top and along its left and right vertical support legs. A solar module is integrated into the roof which is covered elsewhere by cedar shakes. All outer members as well as the roof are cedar which was protected by two coats of stain for durability and for appearance. All wooden components of the original sign are also cedar protected by two coats of stain. A black acknowledgment plaque is evident at the lower center of the sign.

Figure 1. Day view of south-facing sign with roof incorporating solar module.

Illumination is accomplished by four LED (light-emitting diode) flood lights (12.8 W, 650 lumens each) mounted to the underside of the roof, as shown in Figure 2. The end truss structure (cedar) is evident as are the internal supports and roof sheathing (pine). Holes in the roof sheathing boards are for convective cooling of the solar module located above the holes. The roof is protected by a layer of rain and snow shield on the north side and a layer of titanium paper around the module on the south side, beneath the cedar shakes.

Figure 2. Day view of underside of roof showing two LED flood lights positioned to illuminate the south-facing sign.

The battery (12 V, lead-acid deep cycle) which powers the LED lights is housed in a weather-proof box mounted on the east side just beneath the roof peak. At this height, the box is not visible from the highway and the wiring runs from the module and the LED lights to the box are short. The box is locked and designed to be tamper-proof in that mounting screws and bolts are not accessible from the outside of the box.

Figure 3. Day view showing weather-proof box containing the battery and control electronics and mounted beneath the peak of the roof on the eastern side of the sign.

Figure 4 shows the components and their wiring inside the box. Charging current from the module (60-cell, 255 W) to the battery is controlled by the unit in the upper left (270 W maximum input, 20 A maximum output). Key electrical parameters are displayed by the unit in the upper center (battery voltage and state of charge, module current and voltage, cumulative Ah of charge drawn from battery, cumulative Ah of charge supplied to the battery, output current from battery, timing of current to LED lights). A temperature-sensor is connected to the negative terminal of the battery so that charging parameters (voltage and current) can be adjusted for ambient temperature – important for an outdoor application such as this. Electrical leads from the module and the four LED lights enter the box via three feedthroughs on the rear of the box. The individual components are protected by fuses (25 A to battery, 15 A to module, and 5 A to each LED). The system is electrically floating, i.e., not connected to a ground rod.

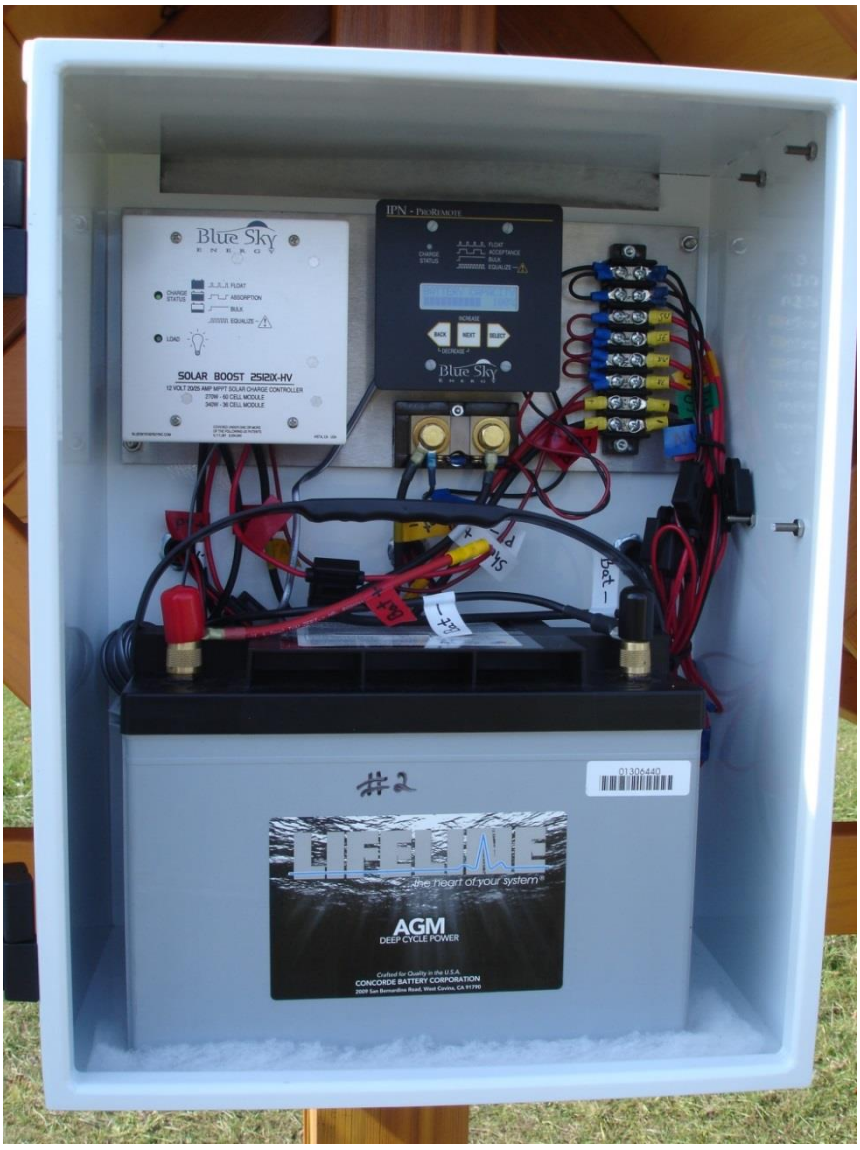

Figure 4. Day view inside the weather-proof box showing the battery, charge controller (upper left), and display (upper center) to monitor electrical parameters.

As shown in Figure 2, the LED lights are mounted on the inner surface of the roof, where they are hidden from the view of passing motorists. Figure 5 is a photograph taken after dark from the eastern side of the sign, with part of the north-facing sign shown. All four energized LED lights are visible.

Figure 5. Night-view of energized solar lighting system showing four LED flood lights mounted on the underside of the roof and illuminating both sides of the sign.

Finally, an after-dark image of the south-facing sign is given in Figure 6. Note that the roof is not visible, as no light illuminates the outer roof surface. However, the full sign is visible because the light is trained on the sign. It is worth pointing out that the roof structure was designed and placed so as not to interfere with the image of the full sign, as viewed by passing motorists during either day time or night time hours. After experience is gained on the amount of charge supplied daily by the solar module to the battery, the number of hours that the LED lights are energized per night will be adjusted accordingly. Currently, the system is set to deliver a total of eight hours of night time illumination, with a specified current of 0.92 A/LED. Hence, 29.4 Ah hours of battery charge would be consumed per day, which is considered sustainable. Even with little battery charging during the day (three successive very cloudy days), the design allows for lighting to occur for approximately three successive nights as a worst-case scenario. To protect the battery, the system will not energize the lights if the battery charge falls below 40 Ah (> 60% depth of discharge from its 100 Ah fully-charged state). Once the battery is charged by the solar module to 80 Ah or more, lighting will resume.

Figure 6. Night view of illuminated south-facing sign.

This lighting system has been designated the LDH-SL4 to indicate that it is a Lightdrop Harvest product which provides Solar Lighting from 4 LEDs. Its success is in no small part due to the craftsmanship of Charlie Grazioli in creating and fabricating the roof structure and in all phases of installation, and the advice of Bob Stoehr regarding choice of components.