

The Elizabethtown College Solar Cabin Project Summary

Elizabethtown College awarded a \$7500 Strategic Grant as a springboard to a research project called the “Standalone Green-power for Village Settings Initiative.” This \$7500 internal grant, combined with \$7000 in start-up funds from Professor McBride and generous cooperate donations (including a Cypress Semiconductor Corp. and Sunpower Inc. donation of \$10,000 worth of high efficiency solar panels and a B&G Lumber donation of \$2500 in material discounts) has allowed us to build a small prototype solar cabin on campus. Thirty-one students (22 1st years and 9 2nd years) with Professors Fullerton and McBride designed the solar cabin in the Spring of 2006 and constructed the exterior of the cabin and connecting raised walkway. In the Fall of 2006, eight students are working to finish the interior of the cabin, the control system, and energy storage system as part of the elective course Engineering Research / Project.

The small 200 square foot cabin has twelve solar panels (eight Sunpower SPR-215 and four BP SX-120 modules) mounted on the roof with a rated peak power totaling 2200 Watts. The cabin will be completely standalone and is designed as both a student study cabin and as a platform to test and demonstrate alternative energy storage systems. In this project, we specifically explore non-battery (electrochemical) based energy storage techniques. While batteries are widely used and moderately effective, limited lifetimes, cost, and size, as well as environmental disposal concerns compel us to explore other technologies. Energy storage techniques such as pumped hydroelectric, flywheel, ultracapacitor, hydrogen and compressed air systems all show promise for substantially improved lifetime and reduced lifecycle environmental impact for various applications. The solar cabin system will use a pneumatic / oil hydraulic energy storage system; an additional hydrogen electrolysis system may be installed in the future to utilize excess power when primary energy storage is full.

The solar cabin serves as both a **student study cabin** and as a **platform to test and demonstrate alternative energy storage systems**. The next step in the “Standalone Green-power for Village Settings Initiative.” involves a proposal to build a full scale "village center" installation. This full-scale system would be a working example for installations in international rural villages with poor or no electrification. The end goal of the project is to provide a powered building as a center to communities in developing areas. The powered building may act as a school, library, kitchen, clinic and/or workplace. It could be used to draw water from wells or store food in refrigerators, heat food, run medical devices, or other electronic equipment. For a specific village, we are unable to address specific needs at this time, but are assured that such a facility could be made to be highly beneficial. In helping to provide a highly reliable, low maintenance, long lifetime (>30 years), low environmental impact community center, we have the potential to set a truly positive model of service.

The Initiative’s three step proposal is 1) complete the proto-type solar cabin facility on campus, 2) towards the end of the proto-type project (Spring 2007), propose a full-scale standalone green power design plan to be installed locally, and 3) based on the design and success of the full-scale installation (or separate from it) start a program to find financial grants to build standalone green power systems for select international rural villages.



Figure 1: (LEFT) Original “Artist’s view” of Cabin from West (looking East) (RIGHT) Photograph of the constructed cabin in September 2006.

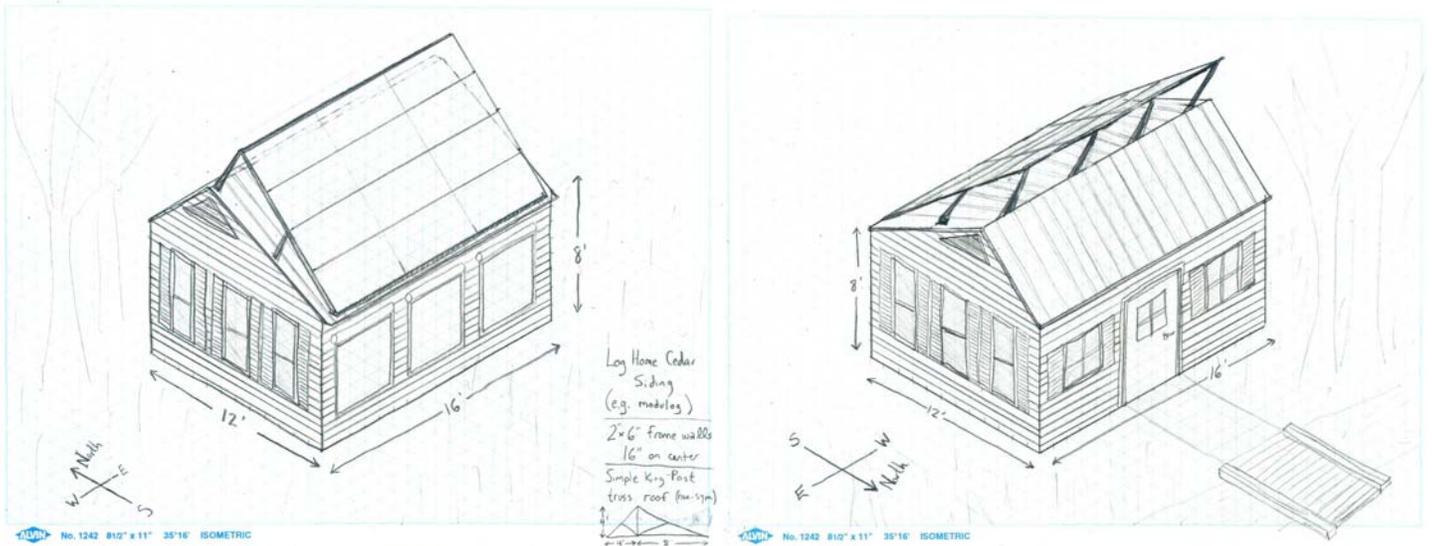


Figure 2: Sketches of solar cabin with dimensions from which student's based their designs

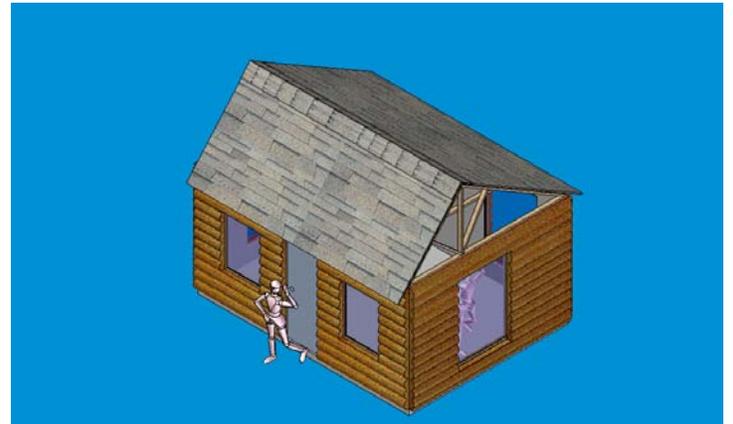
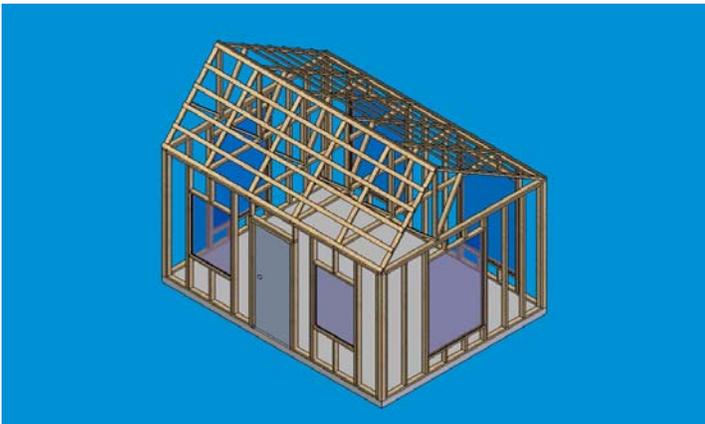


Figure 3: Students design of solar cabin using 3-d modeling software (Solid Edge).



Figure 4: Pictures during the construction of the solar cabin. All design and construction work prior to the log cabin siding was completed by engineering students.



Figure 5: Some more pictures during construction



Figure 6: Site on E-town Map (South is UP and RIGHT) The Elizabethtown College Solar Cabin is located near the constructed wetland swales between the track and the Quads apartments. Note: Sketches are based on ~200 sq.ft. cabin and while I tried to maintain scale it is only approximate. The site is located behind the two constructed wetlands in a flat region.

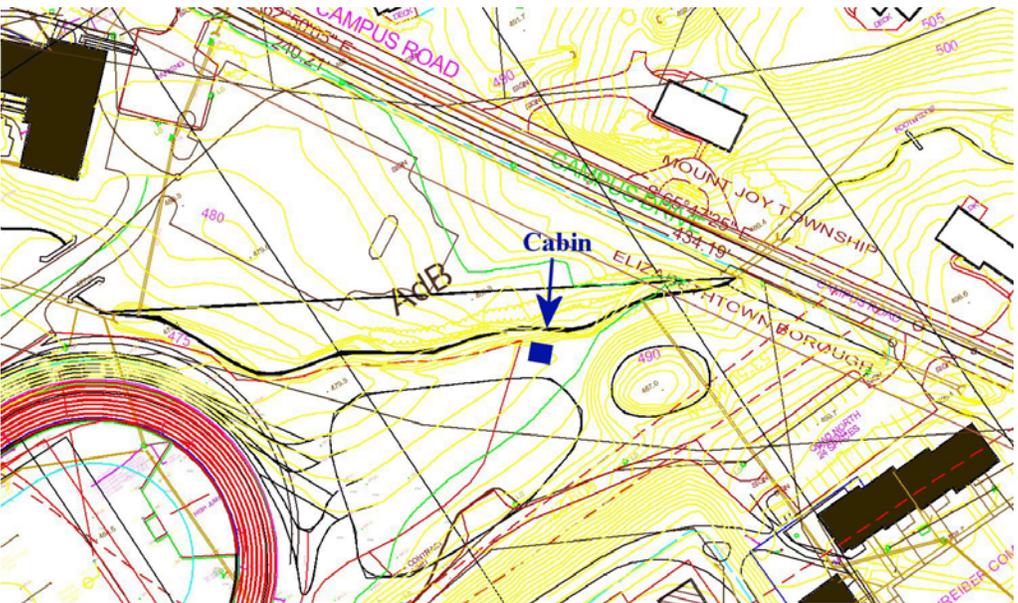


Figure 7: Site on CAD layout: (Orientation changed! South is DOWN)

Miscellaneous pictures prior to and after construction.



Figure 8: View from above on playing field looking north (Young Center through trees at left) prior to commencing construction.



Figure 9: (LEFT) "Artist's View" from above on playing field looking north with Cabin prior to beginning work. (RIGHT) Photograph of cabin in September 2006.



Figure 10: Access through Young Center parking lot.

APPENDIX (Other images)



Figure 11: Bridge (raised walkway) was constructed over this stream (left) – as shown on right. NOTE: Handrail has since been constructed.