

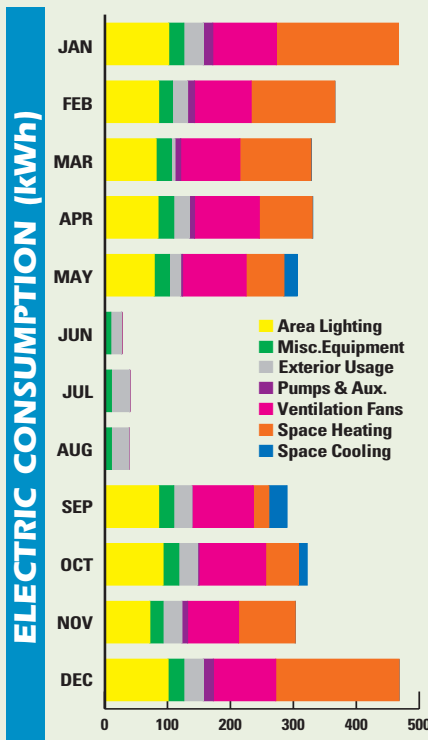
## DEMONSTRATING AND MODELING SOLAR TUBE SKYLIGHTS IN RELOCATABLE CLASSROOMS

### Lighting Classrooms with the Sun!

Portable Classrooms have become the norm for K-12 education in California. These classrooms are mass produced on assembly lines and are built for low first cost. One of the many challenges with these rooms is lighting quality. Most have small if any windows and use fluorescent lighting to provide lighting. Because these rooms are small and not used full time, paybacks on energy-efficient installations are challenging.

This project looks at the possibility of using solar tubes to provide lighting in the classroom and allow the shutting down of the interior lighting. Two classrooms in Fremont were monitored, retrofitted and monitored again to compare the energy use before and after the solar tube installation. This data was then used to calibrate simulations of the classrooms which will be used to study effects of other improvements and climate on the energy use in the portables.

**THE CLASSROOM SITE:** The Fremont Adult School site was chosen because the two classrooms are representative of most of the installations in the field. Classrooms, 26 and 27 are 960 sq ft (standard size), flat roofed, and wood sided steel structures that are used regularly for the Adult School. They are equipped with BARD AC systems and T-8 fluorescent lighting on three level switching.



**TESTING AND ANALYSIS:** Both classrooms were monitored for 15-21 days to determine the electrical use patterns in the building. The two classrooms were then modified by adding 22" diameter Solatube solar tubes in the ceilings.

As part of the demonstration and evaluation, six of these units were installed in one room and eight in the other. The solar tubes feature dampers that allow the adjustment of light levels by light sensor and manually. The ceiling fluorescent fixtures are controlled by relays which, using the light sensor, control the light levels in the room by using the same individual lamp control as the wall switch.

With these modifications complete, the resulting systems were monitored for one month. Information from the resulting pre and post installation data was used to calibrate EnergyPro simulation models of the classroom. The computer models allowed the findings to be extrapolated to schools with normal daily schedules, varying climate and orientation and with various efficiency packages.

**RESULTS:** The Emerging Technologies demonstration project has revealed that the savings were modest for these classrooms, mostly due to the fact that the rooms use only about 3500 to 5000 kWh/yr. However, the models give us some insight into how these classrooms operate and how we might develop more cost effective energy-efficient packages for them.

