



U.S. Department of Energy
Energy Efficiency
and Renewable Energy

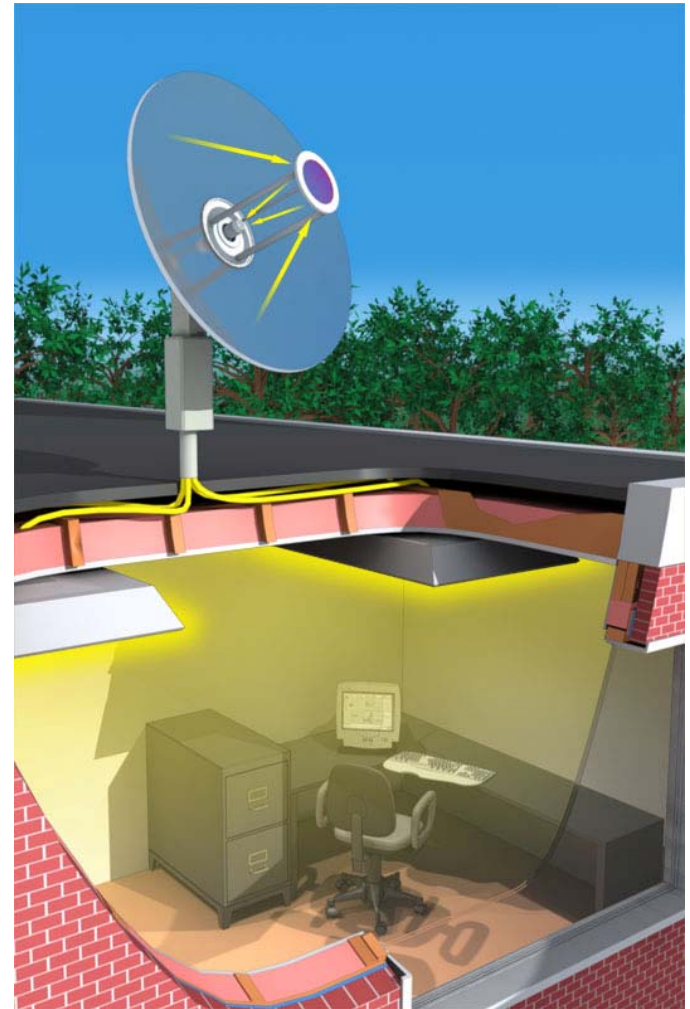
Bringing you a prosperous future where energy
is clean, abundant, reliable, and affordable

DOE Solar Energy Technologies Program Peer Review

Denver, Colorado
April 17-19, 2007



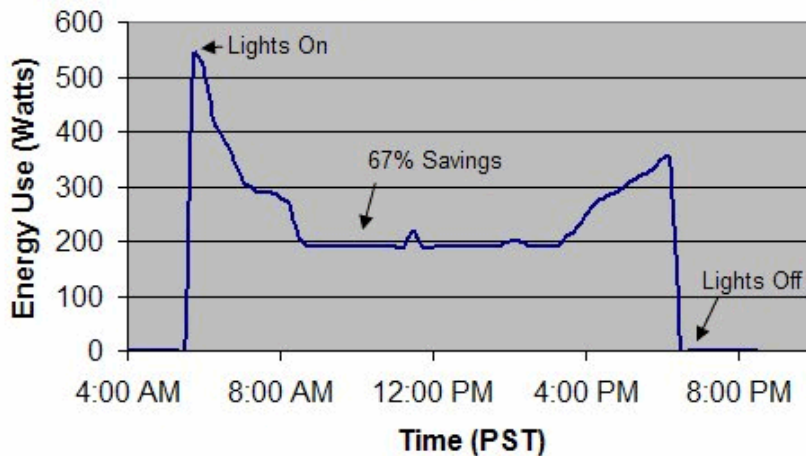
- Hybrid Solar Lighting (HSL) was developed to significantly reduce energy consumption associated with artificial lighting in commercial buildings.
- The HSL technology provides day-lighting to interior spaces and saves energy in two ways:
 - by reducing the electrical loads required for lighting and
 - by reducing waste heat/cooling loads in commercial buildings.
- HSL provides energy savings AND high quality natural lighting (which can help improve student performance, worker productivity, and even sales in retail stores).
- This technology is in the beta-testing phase of commercialization and is expected to launch commercially by Jan. 2008 (Sunlight Direct, Inc.).





- **Beta-Testing:** In June 2006, the first HSL beta-site installation was completed at San Diego State University. A total of 13 beta units have been installed to date.
- **Monitoring:** All beta sites are equipped with an ORNL-designed monitoring system that allows the energy savings associated with the units to be remotely monitored. Data is being collected for analysis and reporting in 2007.

Energy Use at SDSU
(For 06/16/06)



Actual data from 2006/2007 Sunlight Inside Initiative

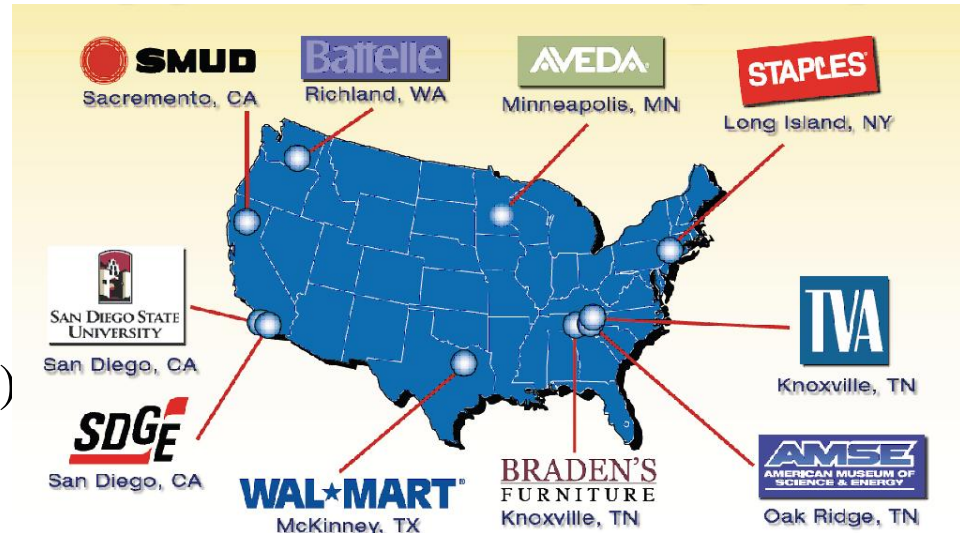


- **Development of Concentrator Optics –** ORNL’s HSL project has pioneered the development of high quality *plastic* optical components that can be used to collect and distribute sunlight with significantly lower cost and higher durability (over conventional materials)
- **Continuing R&D:** Two prototype HSL units are installed at ORNL for continued HSL testing and new experiments targeting CPV applications

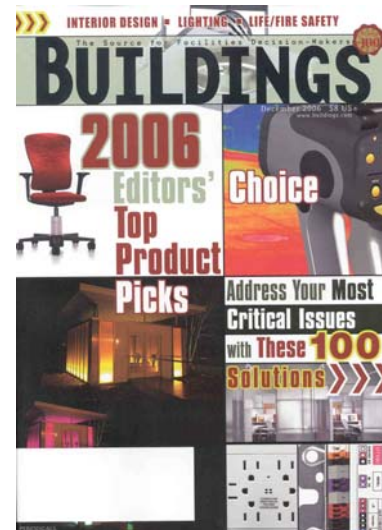


Sunlight Inside Initiative

- ✓ American Museum of Science and Energy (TN)
- ✓ Aveda Corporate Office (MN)
- ✓ Braden's Furniture (TN)
- ✓ Naval Exchange (HI)
- ✓ Oak Ridge National Laboratory (TN)
- ✓ Pacific Northwest National Laboratory (WA)
- ✓ Sacramento Municipal Utility District (CA)
- ✓ San Diego State University (CA)
- ✓ Siskin Children's Center (TN)
- ✓ Utah State University (UT)
- ✓ ORNL Multi-Program Research Facility (TN)
- ✓ Staples (NY)
- ✓ Wal-Mart (TX)



Location of 2006/2007 Beta-Sites



- National Press
- Buildings Magazine
- Discovery Channel
- Canada
- Electrical Line
- Magazine
- Forbes
- MSNBC
- Popular Science
- Scientific American
- Solar Reception



Project Task(s)	FY 2006 Total Value
ORNL (Hybrid Solar Lighting Team)	
Number 1 Beta Collector/Receiver Test & Evaluation	150K
Number 2 Alpha Demonstration Support	70K
Grand Total	220K



- Began evaluation of beta-testing data to be fully reported in FY 2007. Early data shows nearly 70% peak energy savings at beta sites.
- Developed real-time, remote monitoring system to record energy use, tracker performance, and video data from 13 hybrid solar lighting (HSL) beta sites across the United States.
- Produced a high-quality, long-lasting, 48"-diameter acrylic mirror for use with HSL and concentrating photovoltaics (CPV) applications.
- Fully deployed two HSL beta-unit (HSL3100) - one at the Sacramento Utility District (SMUD) headquarters in Sacramento, CA, one at Wal-Mart's experimental store in McKinney, TX
- ORNL researchers were recognized in 2006 with an R&D 100 Award for the HSL system. These awards are presented annually by *R&D Magazine* in recognition of the year's most significant technological innovations.





- Complete design and implementation of improved tracker controller and fiber receiver module.
- Work with commercialization partner to reduce COGS (cost of goods sold) by 50% per square foot over FY 2006 levels.
- Report on benefits associated with 2006 Sunlight Inside Initiative describing energy savings and user feedback.
- Complete 3rd Party Market Assessment of Hybrid Solar Lighting.
- Technical report/paper on long-term improvements and applications of the base HSL platform.

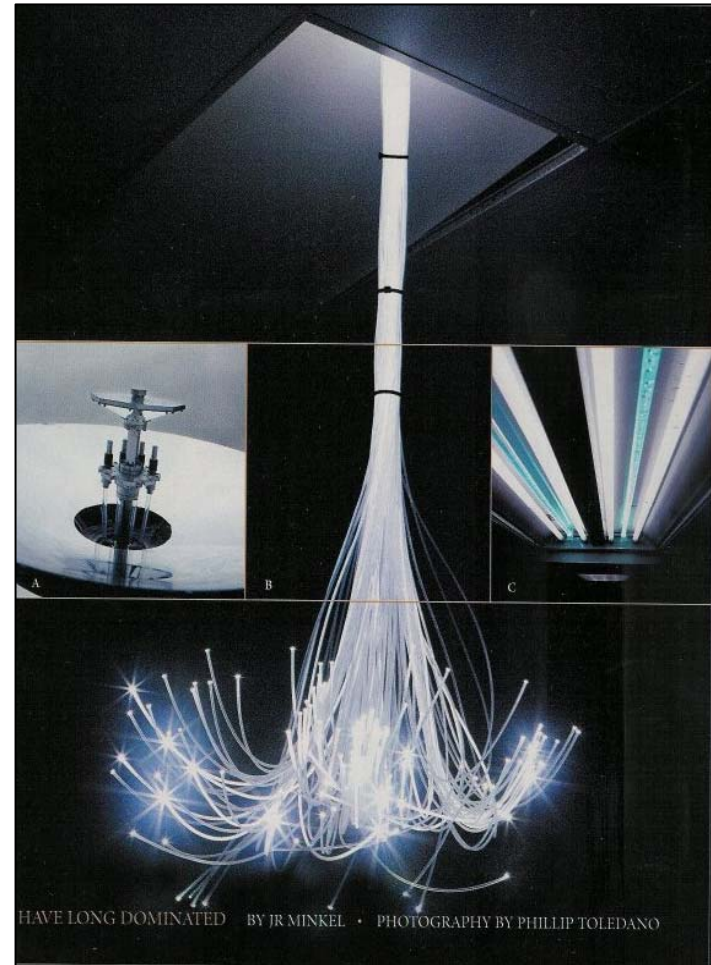


Installation at WalMart Store (TX) – Tracking sales under HSL every 15 minutes



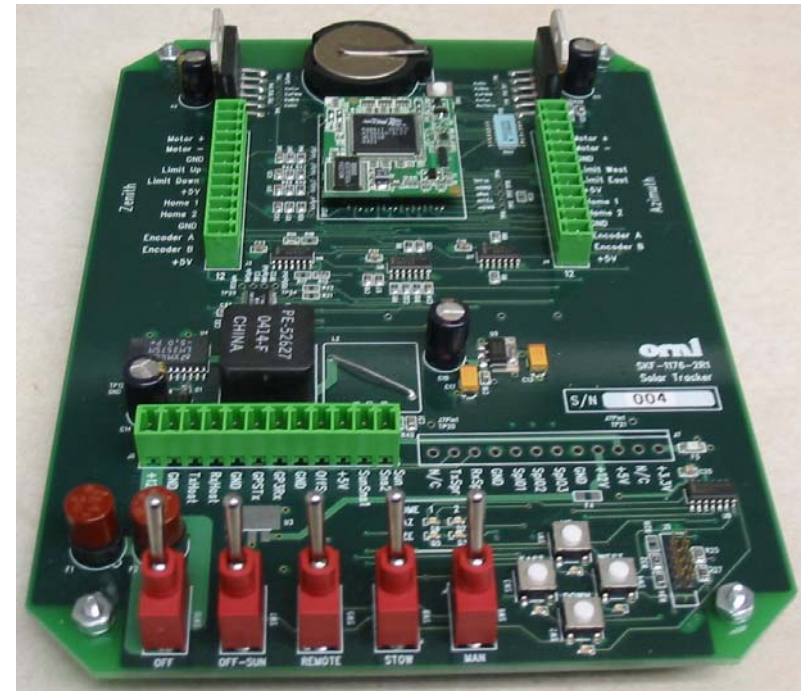
The greatest technical challenges/barriers remaining for the HSL project are:

1. Reliability of the 2-axis tracking mechanism
2. Sustained performance of the collection optics and optical fibers
3. System cost





- **Smart Tracking Controller R&D** - Smarter controls that use feedback sensors and self-learning algorithms and improved mechanical designs combined with extensive testing of the HSL tracker are needed to further improve the HSL system's reliability and lifetime.
- **Cost Reductions** – Combined R&D and industry participation (from Sunlight Direct) is expected to significantly reduce the cost of HSL in 2007. The tracker cost is expected to drop from \$6000 to below \$1000 and the total system cost for HSL below \$4000 (pre-installation) by late 2007.
- **Plastic Optics R&D** – Improvements to plastic mirror quality and optical fiber quality are needed in 2007. Evaluation of fiber optic material alternatives and the development of a larger 64" diameter plastic primary mirror are planned by the end of 2007.



ORNL has developed an accurate and reliable tracker controller that can be enhanced to integrate intelligent, self-correcting tracking algorithms