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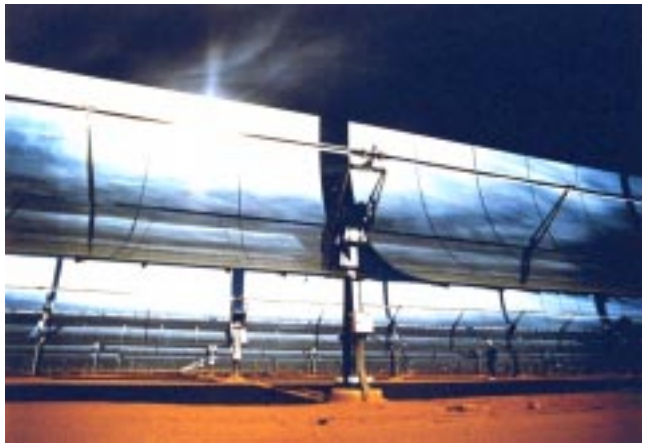
SnapShot

Solar Trough Power Plants

Large-scale, low-cost, reliable solar energy

Using technology initially developed by the Department of Energy (DOE), private industry built 354 MW of commercial solar trough power plants—enough for about 500,000 people—between the mid-1980s and early 1990s. This year marks the fifteenth year of operation for the first of these solar electric generating system (SEGS) plants in the Mojave Desert of California. The nine plants continue to perform as well (or better!) than when first installed, with most producing increased levels of solar electricity in 1998. The DOE's involvement in recent years has been to sponsor a $6 million Operations and Maintenance (O&M) Cost Reduction Study, which was cost-shared on a 50-50 basis with one of the plant operators. The procedures identified and implemented from the study are saving $42 million over the life of the plants. They have advanced the technology and lowered the cost of energy produced by 30% to about 12¢/kWh, the lowest of any solar technology. These results—low cost and proven reliability and performance over time—along with a reinvigorated international industry, have refocused interest on parabolic troughs for near-term application.



SEGS troughs at Kramer Junction, California.

The curved solar collectors of a trough plant focus sunlight onto a receiver pipe through which a synthetic oil circulates. The heated oil is routed through a heat exchanger to produce steam that drives a conventional electricity-generating turbine. As with other renewable technologies, no pollutants are emitted in generating this electricity. The nine SEGS plants range in capacity from 14 to 80 MW and have accumulated more than 100 plant-years of operating experience. The electricity from the plants is sold to Southern California Edison, the local utility, during its peak and mid-peak demand periods. A natural gas system "hybridizes" the plants and contributes 25% of their output, a dispatchability feature that can greatly enhance future deployment options for the technology.

The Next Step: USA Trough

Although it currently represents the least expensive way to produce solar electricity, trough technology is far from being fully developed. In 1998, the DOE's Concentrating Solar Power Program sponsored a technology roadmapping workshop that brought together key internationally recognized experts from industry and laboratories. The findings of the workshop identified significant cost reductions that can be achieved through advanced research, development, and demonstration (RD&D) efforts that will allow U.S. companies to take a lead role in international trough projects currently being considered for financial support by the World Bank. (Projects proposed for Egypt, Mexico, and Morocco are

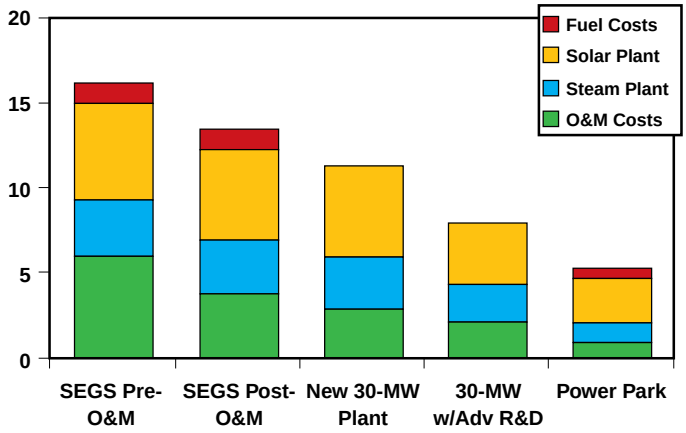
Concentrating Solar Power Program

on the brink of approval, while others in Brazil, Crete, and South Africa are actively being pursued.) When fully implemented in the next few years, these cost reductions will help solar troughs compete with low-cost fossil generation technologies in worldwide markets.
In response to these findings, DOE has launched the USA Trough Initiative, an advanced trough RD&D effort that will bring industry partners together to accomplish a number of technical objectives over the next several years. These objectives include the following:

- Optimizing hybrid integrated solar combined-cycle system (ISCCS) designs to allow maximum solar input without impacting fossil-fired operations;
- Developing trough system designs that provide the best combination of low first cost, low maintenance, and the ability to be produced in a variety of countries;
- Designing and testing advanced components and systems that will be required in the next generation of trough plants;
- Developing thermal storage options that allow nighttime dispatch of solar-only trough plants for applications with evening peak demands; and
- Supporting U.S. industry involvement in early projects.

The figure below charts the actual reduction in levelized energy cost (LEC) resulting from the DOE's O&M Cost Reduction Program in the early 1990's, the projected reduction expected from the USA Trough Initiative, and the future implementation of troughs in large solar power park configurations.

Trough Levelized Energy Costs (¢/kWh)



SEGS Pre-O&M (1992) - Actual SEGS VI plant performance and O&M costs before the DOE/Sandia/KJC O&M Cost Reduction Program. The SEGS plants use 25% natural gas.

SEGS Post-O&M (1998) - Shows the benefit of DOE's O&M Cost Reduction Program to SEGS VI. This includes performance improvements and O&M cost reductions.

New 30-MW Plant (2000) - The next trough plant is likely to be an ISCCS using current technology. In this case, the costs shown are only for the solar power.

30-MW Plant with Advanced R&D (2005) - This is an ISCCS plant reflecting the benefits of USA Trough during the next few years, primarily through enhanced performance and further cost reductions.

Future Trough Power Park (2010) - This is a large 200-MW SEGS plant built in a power park configuration. The cost reductions are primarily a result of building multiple (e.g., five) large plants. This scenario also assumes a production tax credit similar to the Renewable Energy Production Incentive.

A "Sunny" Future

Parabolic trough technology is the lowest cost solar power option available today, providing megawatt-scale installations with a sufficiently long and successful track record to be considered by international lending institutions as an excellent candidate for power projects in developing countries. While the major early opportunities will be in providing power to some of the two billion people in the developing world currently without electricity, the technology advancements pioneered over the next few years will also reopen the domestic market for trough technology. These opportunities will obviously be enhanced through the implementation of renewable energy portfolio standards, green pricing, and other environmentally driven incentive programs.

Aerial photo of the SEGS plants in Kramer Junction, California.

For on-line information about the U.S. Department of Energy's Concentrating Solar Power Program, please visit its web site at: **http://www.eren.doe.gov/sunlab**

For more information on renewable energy or for additional copies of this brochure, contact the Energy Efficiency and Renewable Energy Clearinghouse (EREC): **1-800-DOE-EREC (363-3732)**

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