NREL
NATIONAL RENEWABLE ENERGY LABORATORY

ENERGY SYSTEMS INTEGRATION

ESI optimizes the design and performance of electrical, thermal, fuel, and water pathways at all scales.

PARTNERSHIPS

NREL + SPI SOLAR/ TRIMARK

NREL is partnering with SPI Solar, a renewable energy developer, and Trimark Associates, an energy systems SCADA provider, to evaluate parabolic troughs for concentrating solar power plants. Parabolic troughs are mirrored devices shaped like watering troughs, and the open end of the trough is pointed at the sun to concentrate the sunlight onto a heat-receiving tube located at the focus of the mirror. The receiver tube absorbs the sun's energy and transfers it to a fluid that is used to generate electricity. Because of the high temperatures involved, the receiver tube must be insulated to hold the heat in, but it must also allow the maximum capture of solar heat. For this particular test, NREL is evaluating the optical and thermal properties of SPI Solar's receiver tubes.

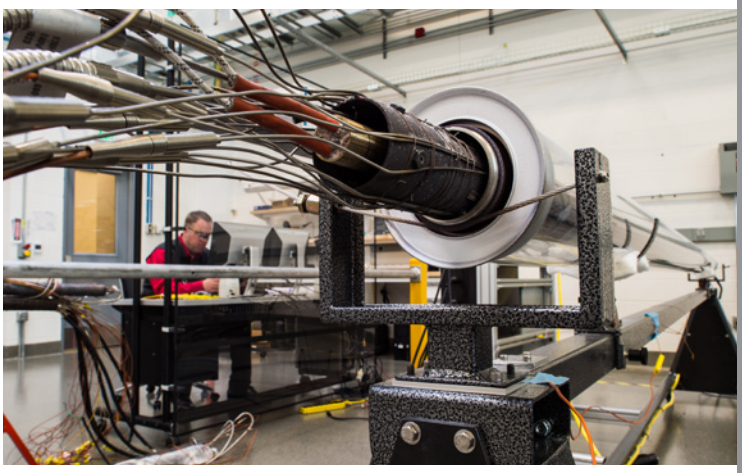
R&D STRATEGY

NREL's Receiver Test Station is being used to test the heat loss of a prototype receiver tube at five temperatures between 150°C and 450°C. The Receiver Test Station uses electric resistance coils to heat the tube from the inside, and the level of heating is adjusted until the receiver tube stays at the desired temperature. At this point, the electricity used to maintain the desired temperature is equal to the heat loss of the receiver tube.

To measure the optical efficiency, the receiver tube is being exposed to ambient sunlight using NREL's outdoor thermal transient test, in which the tube is filled with a steel support that holds aluminum shot and is then exposed to natural sunlight. As the tube heats up, the temperature of the metal filler material is tracked against time to determine the optical efficiency of the absorber tube.

IMPACT

The receiver is the key component of a concentrating solar power plant, and it must endure dramatic temperature changes and mechanical stresses. Optimizing the receiver's performance is critical to maintaining the plant's overall efficiency and to minimizing the cost of the power produced.



A receiver tube—the glass insulating cylinder and the dark inner cylinder—undergoes thermal testing on NREL's Receiver Test Station. The brown-orange wires at the end supply power to a heater, while the other wires connect to thermocouples that measure the temperature of the receiver.
Photo by Dennis Schroeder, NREL 32562

Partner with NREL at the ESIF

User facility access to the ESIF is awarded through the review and approval of user proposals, depending on the scientific merit, suitability of the user facilities, and the appropriateness of the work to DOE objectives, and includes a signed user agreement for the facility.

For more information, please visit:
www.nrel.gov/esi/working_with.html
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The Energy Systems Integration Facility (ESIF) at the National Renewable Energy Laboratory (NREL) provides the R&D capabilities needed for private industry, academia, government, and public entities to collaborate on utility-scale solutions for integrating renewable energy and other efficiency technologies into our energy systems.

To learn more about the ESIF, visit: ***www.nrel.gov/esif***.

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