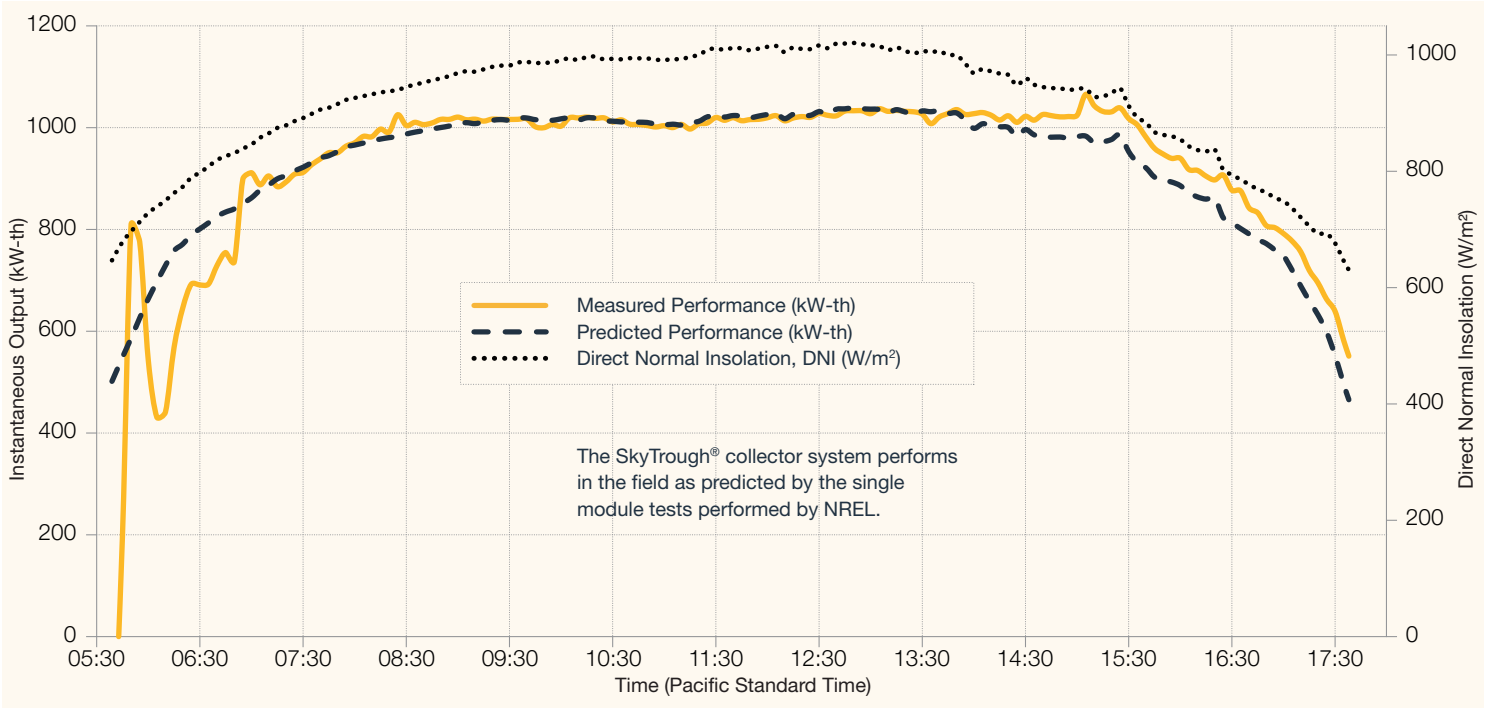
SkyTrough Thermal Performance



Performance Validation Summary

A SkyTrough® collector loop has operated continuously under plant control since February 2010 at SEGS-II in Daggett, California. SkyFuel worked with engineering firm Sargent & Lundy to validate the performance of the collector loop and compare it to a model-based prediction.

The predictive model is based on tests performed by the National Renewable Energy Laboratory (NREL) of collector module optical efficiency and receiver heat loss.

$$q_{predicted} = I_{DN} A_{coll} \eta_0 - q_L$$

The heat output of the collector loop is calculated from measured mass flow rate and temperature of the heat transfer fluid (HTF) at the inlet and outlet of the loop:

$$q_{measured} = \dot{m} \cdot C_p \cdot (T_{outlet} - T_{inlet})$$

η_0 = optical efficiency
I_{DN} = direct normal insolation
A_{coll} = collector aperture area
q_L = receiver heat loss rate

Predicted and measured performance for a single day in June are seen to correspond extremely well. Similar data taken daily for three weeks show that this high level of performance is consistent and repeatable over a wide range of operating conditions.

Previous NREL tests demonstrated that the SkyTrough® has achieved world-class collector performance at the module scale. Sargent & Lundy's analysis confirms that the same performance level has been reliably replicated in a commercial-scale installation.

A complete description of the model and measurement of thermal performance are available in McMahan, A. White, D., Gee, R., and Viljoen, N., *Field Performance Validation of an Advanced Utility Scale Parabolic Trough Concentrator*, SolarPACES, 2010.

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