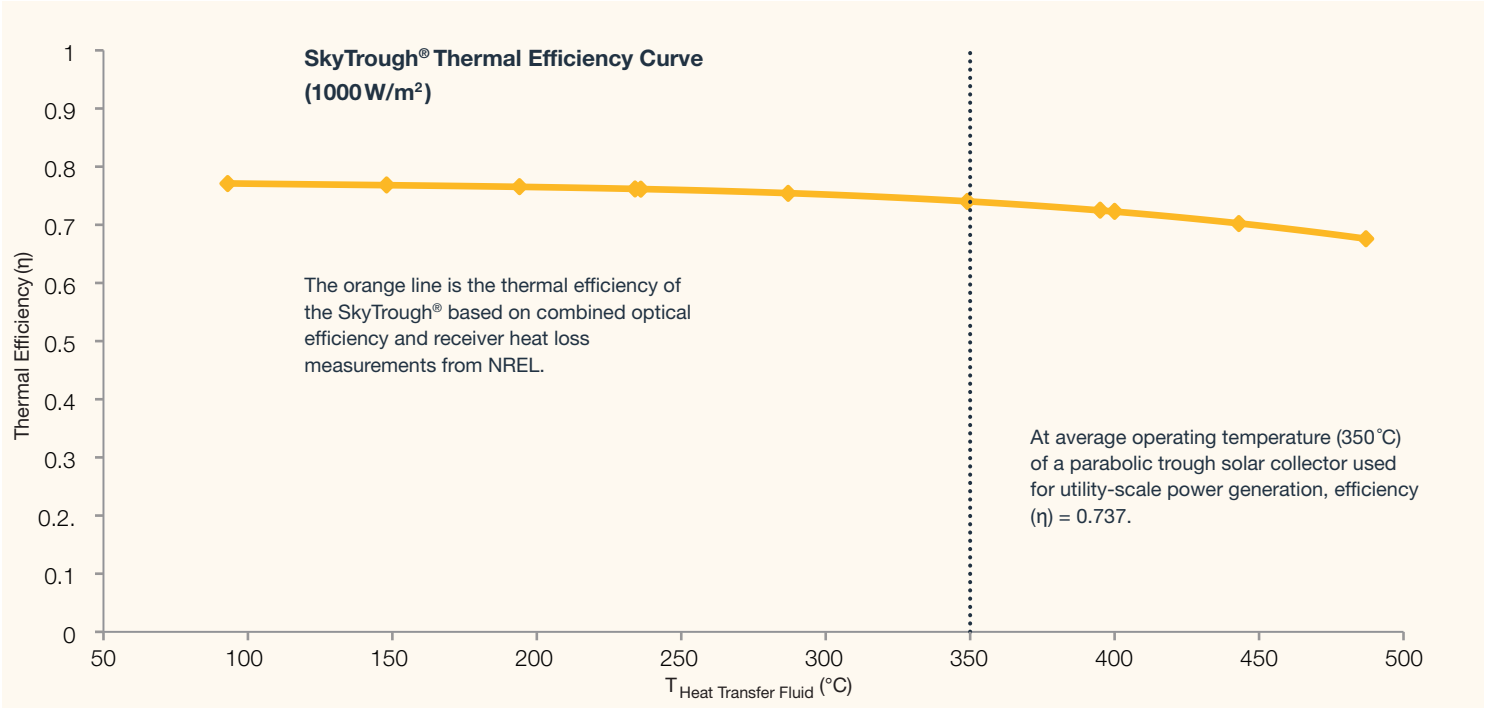
SkyTrough Thermal Efficiency



Efficiency Testing Summary

The National Renewable Energy Laboratory (NREL) independently tested the SkyTrough® parabolic trough collector to determine its thermal efficiency (η) as a function of operating temperature. The thermal efficiency is the proportion of incident radiation that the SkyTrough® turns into useful heat, and is calculated as solar energy captured less heat lost from the receiver:

$$q_{coll} = I_b A_{coll} \eta_0 - q_L$$

Dividing through by $I_b A_{coll}$

$$\eta = \eta_0 - \frac{q_L}{I_b A_{coll}}$$

η = thermal efficiency
η_0 = optical efficiency
I_b = beam irradiance
A_{coll} = collector aperture area
q_L = receiver heat loss rate

The optical efficiency (η_0) is the ratio of the thermal energy collected to the total solar energy striking the concentrator during operation at ambient temperature, and was measured to be 0.773 for a SkyTrough® module at NREL's *Optical Efficiency Test Loop* in Golden, Colorado. Mirror reflectance, concentrator accuracy, receiver alignment to the focal line of the trough, transmittance of the receiver's insulating glass sleeve, and receiver absorptance all affect optical efficiency.

In a separate test at NREL's *Parabolic Trough Receiver Heat Loss Test Stand*, researchers measured the heat loss from SkyTrough's Schott PTR80 receiver at various heat transfer fluid temperatures between 25 and 500 °C.

Combining the optical efficiency result with the receiver heat loss results, thermal efficiency is plotted versus heat transfer fluid temperature, demonstrating that the SkyTrough® has a thermal efficiency of 0.737 at 350 °C.

For more information, please contact:
Info@SkyFuel.com
SkyFuel, Inc.
18300 West Highway 72, Arvada, CO 80007
303.330.0276
www.SkyFuel.com

SkyFuel White Paper – SkyTrough Thermal Efficiency 2010.11
Printed with low-VOC toner on 30% post-consumer fiber produced with 100% wind energy.