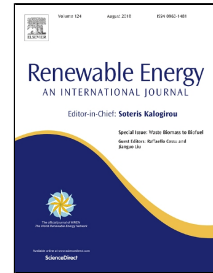


Accepted Manuscript

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PII: S0960-1481(18)30566-4
DOI: 10.1016/j.renene.2018.05.045
Reference: RENE 10097
To appear in: *Renewable Energy*
Received Date: 11 January 2018
Revised Date: 10 May 2018
Accepted Date: 13 May 2018

Please cite this article as: Mark R. Poole, Sanjay B. Shah, Michael D. Boyette, Jesse L. Grimes, Larry F. Stikeleather, Evaluation of landscape fabric as a solar air heater, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.05.045

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Evaluation of landscape fabric as a solar air heater

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Abstract

Solar heating has great potential to displace fossil fuels in agricultural and industrial space heating. The conventional metal transpired solar collectors (mTSC) is highly-efficient but its high cost has impeded its adoption. While the plastic TSC (pTSC) would be less-expensive than the mTSC, it requires perforation. Since a high absorptance, non-woven landscape fabric is widely available and inexpensive, it could be cost-effective solar collector. The landscape fabric collector (fTSC) was compared with mTSC (anodized aluminum) and pTSC for temperature rise (ΔT) and efficiency (η) at two suction velocities (V_s). The mTSC and pTSC had porosity of 1.2% while the fTSC had a porosity of 80%. At 0.047 m/s, the fTSC produced higher average ΔT (by at least 2 °C) and average η (by at least 10%) than the mTSC and pTSC that were similar in performance. At the higher V_s of 0.060 m/s, the fTSC slightly outperformed the mTSC while the pTSC had the lowest ΔT and η . Superior performance of the fTSC was likely due to lower energy losses than the other two collectors as was indicated by its scanning electron microscope images. Modeling the fTSC as a simplified packed bed may be appropriate and challenges have been identified. Practical scale-up suggestions are provided. The fTSC is the least expensive solar air heater for space heating.

Keywords: Transpired solar collector, UTC, Landscape fabric, Temperature rise, Modeling

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