

Accepted Manuscript

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PII: S0360-5442(17)31768-1

DOI: [10.1016/j.energy.2017.10.063](https://doi.org/10.1016/j.energy.2017.10.063)

Reference: EGY 11707

To appear in: *Energy*

Received Date: 2 June 2017

Revised Date: 10 October 2017

Accepted Date: 15 October 2017

Please cite this article as: Thapa S, Borquist E, Weiss L, Thermal energy recovery via integrated small scale boiler and superheater, *Energy* (2017), doi: 10.1016/j.energy.2017.10.063.

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Thermal Energy Recovery via Integrated Small Scale Boiler and Superheater

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Abstract

A small-scale exhaust energy recovery system has been designed and tested using MEMS (Micro-Electro Mechanical System) fabrication techniques in combination with Additive Manufacturing. The system extracts thermal energy from low temperature exhaust flows with a porous copper heat exchanger and passes that energy to a unified superheater / boiler.

MEMS fabrication techniques were utilized for the boiler and Additive Manufacturing (3D printing) was used to combine with the superheater. Capillary channels were utilized within the boiler to achieve internal working fluid pumping action. The phase changed working fluid was then passed to the superheater for superheat. The prototype system was tested in two configurations: first with boiler atop exhaust heat exchanger and second with combined boiler and superheater working in combination.

The boiler operating without superheater captured 66% of incoming thermal energy. Operating in combination with the superheater showed a 10%

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