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# Parametric study of stirling engine regenerator designs

**Timothy Marbach**
California State University, USA

Electrical energy generation from a Stirling engine has reached an efficiency of about 40%. However, micro-scale Stirling engines (≤10 kWe) have not produced power at an economically competitive rate. The working fluid in a Stirling engine has typically been hydrogen, helium, or air. With the rising cost and decreasing availability of helium, safety concerns and increased manufacturing costs associated with hydrogen, and low performance associated with air, the choice of working fluid is of increasing importance to an economically competitive design. When a suitable design enters mass production, the price per kWe is expected to drop to within the competitive range. The goal of this paper is to investigate the performance of different regenerator designs in a solar powered 10 kW Stirling engine. The analysis consists of two models: an overall model of the 10 kW engine and a detailed CFD model of the regenerator. The models are validated using data from various journal articles describing similar systems. Additionally, a parametric study including regenerator material, geometry, and working fluid was completed. The resulting data from the CFD analysis was then input into the overall engine model, which is solved numerically. The resulting engine performance data was plotted and compared against the other regenerator designs. The results identify the most critical variables in regenerator design and their impact on the overall operation of the Stirling engine.

## Biography

Tim Marbach completed his Ph.D. in Mechanical Engineering from the University of Oklahoma in 2005. He is currently an Associate Professor of Mechanical Engineering at California State University Sacramento, where his research work focuses on combustion and heat transfer for sustainable energy and food engineering applications.

marbach@csus.edu