

# Project Recap

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## Humanitarian Engineering – Biodiesel Boiler System for Steam Generator

Currently 70% of Kenyan citizens survive as subsistence farmers making less than \$1 per day, creating significant need for technological advancements leading to an improved quality of life. Limited access to electricity is a large factor restricting farmer productivity and thus meeting this need provides an excellent opportunity to create a technology pull towards a higher standard of living. Our team, working in collaboration with the Jomo Kenyatta University of Agriculture and Technology (JKUAT), was tasked with designing a low cost biodiesel boiler system to drive a steam engine generator. This system is to provide electricity to subsistence farmers in rural Kenya in addition to creating new, sustainable business opportunities within the country. In order to best meet these criteria, a survey of Kenyan subsistence farmers and future business owners was conducted to determine how to best meet their needs. The design process was focused on creating a product which could be manufactured using affordable materials available in Kenya while, most importantly, ensuring safety during operation.

After evaluating several different design concepts for meeting the customer needs, a boiler fueled by biodiesel and outputting to a steam engine was decided upon. The system utilizes the jiko, a cooking device used by a large majority of Kenyan subsistence farmers. A counterbalance feature was incorporated in the design to act as an automatic safety feature. The team successfully developed a first iteration design providing proof of concept that will allow future iterations to reduce cost and improve efficiency. This successful prototype outputs 1.2 KW of steam at 9 psig which is within the operating points of the engine. A total system thermal efficiency of 20% was achieved. The overall system efficiency of generating electricity from the biodiesel would need to be calculated considering the efficiency of the steam engine and alternator. Overall, the design process was successful in providing a working design that has the potential to be implemented following future iterations of cost reduction.