Development of Hybrid Micro Combined Heat and Power System Based on Solar Thermal and Biomass Resources
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GOAL

The project aims to develop a stand-alone system with a power capacity of 3 KW and a heating load capacity of 5-10 KW using an Organic Rankine Cycle as the prime mover. The goal is to develop a micro-combined heat and power system utilizing solar thermal and biomass resources to provide power and heat to off-grid rural areas and urban areas replete with an unreliable power supply in Pakistan.

Solar Loop TRANSIENT SIMULATION

Heat Transfer Oil Temperature from Compound Parabolic Trough Collector Outlet (Annual Temperature Distributions)

ORC Thermodynamic Model (EES)

Biomass Gasifier Testing

COST BENEFIT ANALYSIS

24/7 Energy
Washing/Heating
Cooking
Fertilizer

Investment IRR @ 22%:

USPCAS-E NUST in collaboration with Oregon State University and Arizona State University under USAID Joint Research Project is on the way to develop stand alone CHP system targeting off-grid areas of Pakistan (35-40% off-grid population). According to the preliminary feasibility analysis, a 3 KW electrical and 10 KW thermal system gives 22% IRR for the investment of Rs. 1 Million. The benefits include 24/7 energy security (day time Solar Thermal and Night time biomass gasifier), Bio-gas for cooking, hot water and bio-char as fertilizer. After conceptual design and simulation, testing and validating of proposed system is ongoing, in this regard a complete test bed is being developed at USPCAS-E NUST.