CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
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Project Number
J0206

Project Title
Off the Grid by a Yard

Abstract

Objectives/Goals
My project was to determine if I could generate enough energy in my backyard, equivalent to my part of the electricity bill, using a solar panel, a wind generator and a biogas generator.

Methods/Materials
For my biogas generator, I built a bellows, a scrubber (removed hydrogen sulfide from methane), filter (removed CO2) and connected hoses/pipes to two 275 gallon tanks and my septic tank; built the mounting structure for my pulleys, bellows, motor and generator. I pulled raw methane via the bellows into the scrubber and filter to clean the methane before sending it to my 3.5 hp engine which turned pulleys to pulse the bellows and turn my generator. I connected the generator to my test and monitoring station which included a volt meter for measuring voltage, a precision resistor load box (generator load) and a computer for tracking data. I ran the biogas generator for as long as it could run on the methane. Once the gas was expended, the motor would stop. I tested the generator under different loads -- 4, 8 and 16 Ohms.

I built a stand for my solar panel out of wood. I connected it to my test and monitoring station. I recorded voltage different resistor loads -- 4, 8 and 16 Ohms. I took stored results and plotted them on a graph on the computer.

Results
The wind generator produced an average of 2.966 watts/hour and generated for about 9 hours/day equated to an average of 26.69 watts/day. Escondido does not experience sufficient wind to produce a significant amount of energy.

The solar panel produced about 482 watts per day.

The biogas generator and one section of my septic tank produced about 8 ft# of methane which equates to about 3,050 BTUs (890 watts/day). However, due to system inefficiencies and limits of my storage tank, I achieved 24 watts during 3-5 minute runs.

My average total daily electrical production was 532 watts/day.

Conclusions/Discussion
I could not produce enough energy in my backyard to power my part of the electricity bill. My testing revealed I needed more efficient designs and significantly more capacity on all of my sources to produce 2.72 kWh/day.

Summary Statement
I generated electrical power from biogas, solar and wind generators in my backyard to try to produce an equivalent amount of my part of the electricity bill.

Help Received
Technology teacher helped with electrical/electronics, friend built my pulleys; Dad helped me build the bellows, wind generator, solar stand, filter seals and assemble equipment on mounting board.