CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)
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Project Number
J0917

Project Title
Pine Needles and Oak Leaves as a Source of Renewable Energy

Abstract

Objectives/Goals
The project objective was to determine if pine needles or oak leaves in forest floor leaf litter have diferent a caloric content when burned.

Methods/Materials
Three forest locations were selected for random sampling. A 100 square yard grid was laid out at each location. Using a random number generator, three square yards of leaf litter was collected from each location, for a total of nine representative samples.

From each of these 9 larger samples, three smaller samples, approximately 6 grams each, were burned in a calorimeter to determine caloric output. 500 grams of distilled water in the calorimeter had initial and final temperatures recorded. Three temperature change data points were produced for each original sample collected.

Results
Results showed that pine needles had a higher heat output, in Kilocalories per gram than did oak leaves. The highest calculated weight of pine needles per acre in my experiment could produce 2,646,764 Kcal/acre using a boiler.

Conclusions/Discussion
I discovered that pine needles had the greatest caloric output compared to oak leaves. Pine needles burned longer and hotter which raised the temperature of water in the calorimeter more per gram than the oak leaves did. The oak leaves just smoked a lot and the flames died.

Pine needles make up the bulk of Nevada County leaf fall, meaning that this resource is abundant. The idea of employing rotational leaf farming techniques and using pine needles to generate heat to make electricity is an excellent one, because tree litter is a constantly renewing resource.

One Kcal of heat energy is approximately equal to 0.001 kilowatt-hour (KWh) of electrical power. Approximately 2,600 KWh of electrical energy could be produced from one acre of pine needles. Therefore, pine needles could be put to good use as a source of renewable energy.

Summary Statement
The project investigated if forest leaf litter could be used as a renewable energy source to generate electricity.

Help Received
Father helped with gathering equipment , driving to sample locations, and helped put display board together; teacher helped with thermometers and reviewed project.