CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
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Project Number
J0223

Project Title
The Cost Efficiency of Solar Power

Abstract

Objectives/Goals
To compare solar-powered lighter-than-air technology to rechargeable electric battery and gasoline power systems for cost efficiency and calculate potential utility in the real world.

Methods/Materials
A framed airship with interchangeable engines was constructed. A detachable module was made with rechargeable batteries, a light-weight airplane gasoline engine, and a customized solar array. The amount of energy/fuel being used (electric or gas), and the velocity of the testing blimp was measured. The cost to recharge the batteries was made from estimates of the amperes used by the battery charger. The cost of the gasoline used was measured as well. Calculations were then used to find the overall cost for the vehicle to travel a kilometer. In extrapolation to real life, calculations were made of the cost for each of the engine types to transport a real person and the cost for creating a real vehicle to do so.

Results
Ten time trials showed on average a 2cc gas engine lasted 1.99 minutes, the rechargeable battery lasted 56.29 minutes, and the solar panels powered while light was available. Ten distance trials over 20 feet (6.096 meters) demonstrated the gas-powered module took 7.31 seconds, the battery took 13.29 seconds, and the solar apparatus took 13.44 seconds. The cost per kilometer for gasoline power was 0.013 $/km, the battery was less expensive at 0.00097 $/km, and solar had no additional cost. After 6,000 kilometers, gasoline was more expensive than solar, and after 97,000 kilometers solar passes battery technology in efficiency. Further calculations estimated the cost of a solar vehicle for a student-sized person at $90,700 while the cost of a gasoline vehicle approached $76,000; however, the cost per kilometer of gasoline approximated $4.29 and quickly exceeded the cost of solar power.

Conclusions/Discussion
Solar energy provides an adequate alternative to gasoline and rechargeable batteries in this model. Extrapolation showed that although the cost of a solar-powered vehicle is initially more expensive, the cost of gasoline and recharging batteries (using fossil fuels) eventually become less cost efficient. The lighter-than-air craft with solar technology eliminates the need for roads and road maintenance, provides an alternative power source to fossil fuels, and, as extrapolated in the calculations, may eventually provide a workable alternative to the standard automobile.

Summary Statement
A solar-powered lighter-than-air vehicle may be more cost efficient than using gasoline or rechargeable battery technologies.

Help Received
My science teacher, Mr. Snell, showed me about electricity and wiring, and helped with editing; my Dad helped show me how to solder the solar panels and electrics, assisted with getting the supplies, and checked my calculations; my Mom was my assistant in running the trials, and helped me with editing.