CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
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Project Number
S0719

Project Title
Speed and Efficiency Relationships in a Direct Current Motor in a Light Electric Vehicle Application

Abstract

Objectives/Goals
The objective of this project is to find the most efficient speed at which to run a Light Electric Vehicle(LEV). This would be the speed at which the batteries have the least drop in voltage over a specified distance. I hypothesized that the most efficient speed would be approximately 75% of top speed. Top speed is the speed achieved when the motor is run at its highest rated amperage.

Methods/Materials
This project uses a homemade electric bicycle, a handheld GPS and a digital voltmeter as the primary materials. The electric bike is equipped with two twelve-volt sealed lead-acid batteries, a 24-volt DC motor, and a Pulse Width Modulator which is the speed controller in this experiment. For the experiments, the bike was run at different speeds for the same distance in seperate trials after the batteries had been recharged to the same voltage, (e.g. 16.8mph for 1 mile, 2 miles). The voltage is measured before and after and then the drop in voltage is used to determine the most efficient speed at which to run the bike.

Results
The test trials at 75% and 87.5% of max speed were the most efficient. While the test trials of 25% essentially had the same drop in voltage, it took almost 4 times as long to cover the same distance. The least efficient trials were 100% and 50% in that respective order. An additional intermediate trial was run at 62.5%

Conclusions/Discussion
My hypothesis was proved mostly correct through my experimentation. The most efficient speed at which to run the bike was between 75% and 87.5%. This research is important because it will help in the advancement of Light Electric Vehicles (LEV's), helping solve the LEV vehicles most significant problems, which is lack of range. Further experimentation with different types of batteries and more specific measurements with voltage draw over greater distances to magnify the variances are on the drawing board.

Summary Statement
This project utilizes a homebuilt light electric vehicle to measure efficiency in a direct current motor by measuring voltage drop in the power source of the LEV over a controlled distance.

Help Received
Dad helped with transportation, funding, safety, LEV design and construction and editing of presentations. Grandpa provided electronics advise.