CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
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Project Number
J0719

Project Title
Back from the Dead: Charging NiMH Batteries from "Dead" AA Alkaline Batteries

Abstract

Objectives/Goals
To evaluate 3 different methods of transferring residual energy from "dead" AA batteries into a nickel metal hydride (NiMH) battery to make it useable.

Methods/Materials
A NiMH battery charger was designed and built. It uses 8 "dead" AA batteries, connected in series and in parallel, as a power source. The efficiency of 3 different systems was evaluated and compared: direct connection, fuel cell intermediary, and capacitor intermediary, each of which could be chosen by a series of switches. 1 set of 8 "dead" AA batteries was used for each of 2 tests of the 3 conditions. Each experiment was run until voltage levels in the NiMH battery plateaued. Voltage in the AA array was measured before and after each discharge. Amperage flowing through the circuit during energy transfer was also measured and recorded.

Results
The Direct Connection method took between .2 and .6 volts from the AA array to charge the NiMH battery to 1.3 volts. There was a decrease in the flow of amperage through the circuit over time as the energy was transferred.
The Fuel Cell method took between .23 and .46 volts from the array to charge the NiMH battery to 1.3 volts. There was an increase in amperage flowing through the circuit as the fuel cell stack generated electricity from the hydrogen produced by the reversible fuel cell (powered by the AA array), as it charged the NiMH battery.
The Capacitor method transferred the largest amount of voltage on the first discharge, and drained the least amount of total voltage from the AA array.

Conclusions/Discussion
All 3 methods were shown to successfully increase voltage in the NiMH battery. It appears that the capacitor system it may be the most efficient method, based on the amount of voltage drained from the AA array. However, in the course of this project I learned about battery capacity (mA X time) which is what is measured by battery testers, which place a brief load on the battery while measuring its output (though testing the battery also drains some of its energy). Next year I want to find a way to measure capacity in the NiMH battery quantitatively so I can run a lot of experiments with my system and see how much total useable energy can be transferred from "dead" AA into NiMH batteries, and how many times it can be repeated before the AA batteries are truly dead.

Summary Statement
Residual energy in "dead" AA batteries can be used to charge NiMH batteries, which could have significant environmental/energy implications if proven practical and implemented widely.

Help Received
Mother helped with carpentry involved in making the board (I did circuit design, soldering, and heatshrinks). Dad ran countless errands gathering supplies. Peter David Ph.D., electrical engineer, spent several hours discussing my ideas with me, and helped me work out how to use capacitors for the system.