



**CALIFORNIA STATE SCIENCE FAIR  
2007 PROJECT SUMMARY**

<b>Name(s)</b> <b>Jared M. Clark</b>	<b>Project Number</b> <b>J0809</b>
<b>Project Title</b> <b>Are Fuel Cells Our Future?</b>	
<b>Objectives/Goals</b> My objective was to test if a hydrogen oxygen proton exchange membrane (PEM) fuel cell is more energy efficient than a rechargeable chemical battery.	
<b>Abstract</b> <b>Methods/Materials</b> The mission of my project was to test various types of energy storage devices. I needed to build an experiment to measure the energy in and out. One requirement that was essential for my experiment was that all the energy storage devices had to be reversible, meaning that I could charge and discharge them. That was essential to my experiment because to calculate the energy efficiency, I had to measure both the input energy and output energy. To compute the amount of power out, I needed to measure the voltage and current. I recorded data at constant time intervals. The time intervals were 15, 30, and 60 seconds depending on the type of energy storage device that I was using. I used one hydrogen oxygen PEM fuel cell, one rechargeable chemical battery, and a 1-millifarad capacitor as energy storage devices. Serving as loads were several 1- and 10-ohm resistors. For charging, I used a power supply. For measuring the voltage and current, I used two multimeters. After constructing a circuit to charge the energy storage device, I measured the voltage across the energy storage device and the current around the circuit. I reversed the circuit so that it was discharging the cell into a resistor. I measured the discharging voltage and current. I took the data that I read off the multimeters and multiplied them together to get the power. I measured the area under the curve of power over time to obtain the total amount of energy. I used the ratio of energy out over energy in to get an efficiency percentage. I preformed three trials to get an average efficiency for each energy storage device. My project was a success and the results told an interesting tale.	
<b>Results</b> My results showed that the rechargeable chemical battery was more energy efficient than the PEM fuel cell, rendering my hypothesis incorrect.	
<b>Conclusions/Discussion</b> My conclusion is that the fuel cell may not be our preferred energy storage device today but maybe in the future the fuel cell will replace the battery in the quest to be the most efficient in the field of energy storage. Even though the fuel cell is less energy efficient than the battery, it is still more environmentally clean than the battery.	
<b>Summary Statement</b> My project is to compare the energy efficiency of a hydrogen oxygen proton exchange membrane fuel cell to a rechargeable chemical battery.	
<b>Help Received</b> My dad taught me how to calculate efficiency, the trapezoid rule, and the basic laws of electricity.	