



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) James Haraguchi; Edward Vasquez	Project Number S0613
Project Title Determining an Optimum Water Temperature Range for Maximum Efficiency of a Hydrogen Fuel Cell	
Objectives/Goals The Hydrogen Fuel Cell has emerged as an alternative energy source to fossil fuels in vehicles. This project aims to determine the optimal water temperature range for maximum efficiency of a fuel cell.	
Abstract Methods/Materials Reversible Fuel Cell Kit, Distilled Water, Insulated Containers tall enough to hold Cylinders, Weight, Electric Heating Pad, Alligator Clips, Resistor, Digital Multimeter, Electrodes/Thermocouple, Timer. Pre-Test H2O was heated/cooled to a pre-specified Temperature (3, 10, 20, 30, 40 degrees C). Assemble fuel cell/misc. tools. Place Cylinders in Bowl w/H2O @ respective Temperatures & place Weight on Cylinders (leave room for gas escape). Follow #Electrolysis# directions, followed by #Creating Energy# for five trials of ten tests each. Hydrolysis Start timer/battery pack simultaneously. Take Voltage measurements at intervals of 10, 30, 60, and 90 seconds. Take time readings when the H2 tank was bubbling (indicating max H2O displacement) and when O2 bubbles (time elapsed). Shut off battery pack, Reset timer Creating Energy Attach motor/Start the timer. Measure voltage at start (0s), 120s, 300s, and 480s. Measure time elapsed upon the motor stopping. Flush cell with H2O and reset for hydrolysis.	
Results Temperature (degrees C):Avg. Efficiency (%) 3: 19.122 10: 36.067 20:38.425 30:31.485 40:28.410	
Conclusions/Discussion The fuel cell operated at max efficiency at 20OC and had an average efficiency of 38.425% with a Std. Dev. of 11.264. However, the average efficiency of a standard gasoline engine is 25-30%, and a diesel engine#s is 40-50%. Thus, this fuel cell is as efficient as its counterparts are. Though this cell too simple to provide much energy, it represents the future of the energy market.	
Summary Statement This project aims to determine the optimal water temperature range for maximum efficiency of a fuel cell.	
Help Received Parents helped with supplies, design; Mr Mark Grubb helped with data interpretation.	