



**CALIFORNIA STATE SCIENCE FAIR  
2002 PROJECT SUMMARY**

<b>Name(s)</b> <b>Yuvaraj Sivalingam</b>	<b>Project Number</b> <b>J0722</b>
<b>Project Title</b> <b>Air: It's Shocking!</b>	
<b>Abstract</b> <b>Objectives/Goals</b> My project was to determine the characteristics of both the Solar and Methanol Fuel Cells and find out if the Solar Fuel Cell was more efficient than Methanol. I believe that the Solar Fuel Cell will be better because it receives unlimited energy from the sun and is much cleaner than Methanol. <b>Methods/Materials</b> The power characteristics of both the Direct Methanol Fuel Cell and the Solar Proton Exchange Membrane Fuel Cell were determined using variable output resistance loads and using multimeters to measure the output voltage and current. The Solar Cell was connected to the Electrolyzer to produce the Oxygen and Hydrogen from distilled water needed to produce power at the Fuel Cell. The Direct Methanol Fuel Cell was injected with 3% Methanol. The power input to the Solar Cell and the power output by the Solar Fuel Cell were measured using the multimeters which gave the efficiency of the Solar Fuel Cell. The Direct Methanol Fuel Cell was weighed at the start and at the end to note the amount of Methanol consumed, and its energy is compared to the output energy from the Fuel Cell using voltage and current readings against time to obtain the efficiency. This was repeated for each Fuel Cell at different resistance loads. Using a stopwatch, the time was noted for the fuel cells to start producing power and then cease to produce power. This gave the ramp up and decay time. <b>Results</b> The efficiency readings of the Solar Powered Fuel Cell at between 7.51% to 36.42% were higher than the Methanol Fuel Cells# readings at 5.45% to 18.36% for both HHV and LHV. However, Methanol efficiency was higher than that of the Solar Fuel Cell at resistance loads 10 and 33 Ohms. They both had excellent power ramp up times of 1 second. The Solar Fuel Cell continued to produce power for 16 minutes after the fuel source was removed, while Methanol produced power for 1065 minutes with 1 gram of Methanol injected. <b>Conclusions/Discussion</b> The experimentation proved for the most part that the Solar Powered Fuel Cell was more efficient than the Methanol Fuel Cell, except between the output load conditions of 10 to 33 Ohms. The efficiency readings are high given the fact that the Fuel Cells used were small energy producing units as such with high internal resistance. The power producing response for both Fuel Cell types was very quick at 1 second and both kept supplying power even after the fuel sources were depleted.	
<b>Summary Statement</b> To find whether the Solar Powered Proton Exchange Membrane Fuel Cell or the Direct Methanol Proton Exchange Membrane Fuel Cell is more efficient.	
<b>Help Received</b> Father helped make Methanol Solution	