



**CALIFORNIA STATE SCIENCE FAIR  
2005 PROJECT SUMMARY**

<b>Name(s)</b> <b>Michael Madden; Garrett Wymore; Cameron Yu</b>	<b>Project Number</b> <b>J0721</b>
<b>Project Title</b> <b>The Use of a Stirling Engine as an Alternative Energy Source</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> Our objective was to demonstrate running a Stirling engine continuously on light alone, generating energy by maximizing heat, absorption, and transfer of light heating the air that the engine runs on. Our goal was to create a model of a Stirling engine run on sunlight modified for indoor use and demonstrate its potential as an alternative energy source that produces no emissions and uses sunlight that hits the Earth. We also wanted to show its economical advantages by comparing the Stirling engine's initial costs, fuel costs, and long-term costs with other sources of energy.</p> <p><b>Methods/Materials</b> Our first task was to research and build a Stirling engine using parts purchased from an online vendor. We then had to construct a structure to position the Stirling engine and parabolic mirror in a way to maximize the light intensity reflected onto the engine. Experiments were done to determine the ideal parameters of light, color and materials to optimize energy production of the Stirling engine, and the data was analyzed with computerized sensors. After maximizing the power produced by the model and finding the Stirling engine would work continuously just on light, we did mathematical calculations to show it was a very economical choice by comparing it to an internal combustion engine, solar photovoltaic cells, and hydrogen fuel cells.</p> <p><b>Results</b> Sunlight was the most powerful light source, however in the laboratory setting, halogen spotlights produced the most heat. Painting the cylinder cap on the engine black reflected the least light therefore creating the most heat, and using a glass reservoir created the hottest air consistently because of the greenhouse effect. Our research found that the Stirling engine emits no pollutants, while being very cheap compared to photovoltaic cells and hydrogen fuel cells. We calculated that it would take many of these Stirling units to produce adequate energy because of their low energy output, making them just a temporary transitional energy solution until hydrogen fuel cell power is fully available.</p> <p><b>Conclusions/Discussion</b> Stirling engines powered by sunlight are economical and effective alternative energy sources. We reached our goal of making a model to expand public knowledge of a relatively unknown energy source that is an option to higher priced energy alternatives like solar photovoltaic cells and fuel cells.</p>	
<b>Summary Statement</b> We successfully created a model of a Stirling engine run completely on light and showed that it could be an economic and effective alternative energy source of the future because of its economical capabilities.	
<b>Help Received</b> Teacher loaned us parabolic mirror, lenses, light and temperature sensors, graphing calculator, and sensor hub; Mother helped fund project and drove us to stores to buy materials; Teacher got us involved in fair and gave us idea for Stirling engine	