



**CALIFORNIA STATE SCIENCE FAIR  
2005 PROJECT SUMMARY**

<b>Name(s)</b> <b>Danielle E. Frasier</b>	<b>Project Number</b> <b>J0712</b>
<b>Project Title</b> <b>More Efficient Solar Energy</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> I moved into a house with a solar heated pool. The solar technology seemed outdated. I wondered if the technology could be improved by adding electrical energy in combination with the sun's energy. The purpose of this project was to evaluate how much more efficiently water could be heated by adding electrical energy generated by solar radiation (photovoltaic cells) to a homemade solar water heater. A secondary project was to see if there was a difference in efficiency of heating the water between the months of August to January.</p> <p><b>Methods/Materials</b> A homemade solar water heater was constructed. The device was placed in the sun around noon and temperature measurements were taken with a digital thermometer every five minutes for an hour and fifteen minutes. This experiment was repeated eleven times. A 12V battery was charged with a 15watt solar panel for eight hours. The experiment was then repeated using electricity from the battery to light three 12V lightbulbs to generate heat inside the water heater. This second experiment was also repeated eleven times.</p> <p><b>Results</b> The combination of solar energy and solar electrical thermal energy heated the water more rapidly and to a higher temperature than the solar energy alone. In each month from August until January, the combination energy source heated the water more efficiently. The water temperature for the combination energy source was 14.5 degrees C to 17.7 degrees C higher than the solar heater alone.</p> <p><b>Conclusions/Discussion</b> On overcast or rainy days, the combination of solar electrical thermal energy could be used to heat the water to a greater degree than the sun alone. The addition of electrical thermal generated from solar cells in combination with the solar water heater was a far more efficient way to heat water. There was not a significant difference in efficiency for each month.</p>	
<b>Summary Statement</b> This project evaluated how much more efficiently water could be heated by adding electrical energy generated by solar radiation to a homemade solar water heater.	
<b>Help Received</b> Mother helped with board; Dad supervised experiment.	