



**CALIFORNIA STATE SCIENCE FAIR  
2013 PROJECT SUMMARY**

<b>Name(s)</b> <b>Tyler E. Robertson</b>	<b>Project Number</b> <b>J1816</b>
<b>Project Title</b> <b>No Pane, No Gain: How Window Placement Affects Passive Solar Heating</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The objective of my experiment was to determine which direction a house faces will absorb the most heat from the sun and record the highest temperature.</p> <p><b>Methods/Materials</b> Four identical model houses were made out of shoe boxes with identical windows cut out on one side. Each window was covered with a single layer of plastic wrap. The houses were set out in the Sun for twelve trials, oriented in different directions for at least three hours. Using thermocouples, temperatures were monitored every minute in the houses as well as outside the houses in the shade and in direct sunlight. At the end of each trial, data was downloaded directly to a computer for analysis.</p> <p><b>Results</b> The house facing south recorded the highest average temperature difference relative to shade (26.9°F). The house facing south also recorded the highest average maximum and minimum temperatures (94.3°F and 77.6°F, respectively) even above the temperatures recorded in direct sunlight (83.9°F and 66.7°F). Internal house and direct sun temperatures were affected by cloud cover. With occasional cloud cover, temperatures dropped until the clouds passed. When it remained overcast for the rest of the data collection, internal house and direct sun temperatures all dropped to about the same temperature at the same time. The house facing north recorded the highest temperatures on two days. This may have been due to location of the north facing house relative to my home.</p> <p><b>Conclusions/Discussion</b> Thousands of years ago, ancient people used power from the sun to heat their homes. In this experiment, I wanted to see to see how the direction a house faces affects the amount of passive solar heating inside the house. This experiment supported my hypothesis that the house with the windows facing south recorded the highest average maximum temperature as well as the highest average temperature relative to shade. Due to the greenhouse effect, these temperatures were even above those recorded for direct sunlight. When clouds moved in and there was no direct sunlight on the boxes, there was no real difference between the houses. For places where it is cloudy a lot or where there is a lot of fog, having a south-facing window doesn't mean as much for passive heating. For places with sunny climates, passive solar heating can be an effective way to warm your house and can be a good alternative to oil and gas heating systems.</p>	
<b>Summary Statement</b> My project is about how the amount of passive solar heating is affected by the direction a house faces.	
<b>Help Received</b> Mother helped type report. Dad provided thermocouples from his work and taught me how to use Excel.	