



**CALIFORNIA STATE SCIENCE FAIR  
2002 PROJECT SUMMARY**

<b>Name(s)</b> <b>Troy G. Garabedian</b>	<b>Project Number</b> <b>S1509</b>
<b>Project Title</b> <b>Wallpaper Underlayments: A Thermodynamic Study of a New Energy, Time, and Money Saving Idea</b>	
<b>Objectives/Goals</b> Recent events in California and elsewhere increase the urgency of additional energy saving devices that will reduce the total demand and save the consumer money. Here a new idea was given and thermodynamic analysis was done for a novel underlaymnet for wallpaper that could offer additional insulation in a convenient new form.	
<b>Abstract</b> <b>Methods/Materials</b> An experiment was planned to design, construct and test both test apparatus and underlayment prototypes and evaluate performace using a Pasco Science Interface 500 computer program. Heat, from an infrared lamp was transferred through six different undelayments and computer recorded as temperature increased in a "model monitor room" fitted with an electronic temperature probe for 300 sec test periods. Wallpaper alone served as a control against experimental underlayments.	
<b>Results</b> Thermodynamic analysis was performed at three levels. First using change in temperature in monitor box where wallpaper control equaled .093 C/sec, compared to the best underlayment, foil bubble wrap, equaling .007 C/sec. Second, using density of air, and change in temperature from above the joules passing through the six inch by six inch underlayment was found indirectly using $Q$ of the air equals $M \times C \times$ change in temperature. Wallpaper control permitted 40.30 J per 300 second to leak through whereas experimental bubble wrap underlayment permitted only 8.88J. Third, dimensional analysis projected approximate dollar savings on a theoretical 10' x 10' x 10' room, based on a \$.11 kilowatt per hour rate. Energy savings from experimental underlayment were \$67.27 per year over wallpaper alone. Cost benefit and proposed actual product design are presented to help visualize how the product could be convenient for the consumer.	
<b>Conclusions/Discussion</b> Hypothesis is supported for a novel energy saving wallpaper underlayment that may present potential savings of energy and money for the consumer, and the state.	
<b>Summary Statement</b> I used a two chanber test box and a Pasco computer interface to thermodynamically test many different prototype wallpaper underlayments for a cost effective way to insulate your home when you re-wallpaper.	
<b>Help Received</b> Mr. Lake helped me with some of the thermodynamic equations. Mr. Chortanian let me use the Pasco 500	