



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Andrew A. Jakab	Project Number 34407
Project Title Can a Change of State Material Improve Cool Roofs and thus Lower Energy Use in Buildings?	
Abstract Objectives/Goals The objective of this project is to see if the #winter penalty# of cool roofs, i.e. the potential for increased heating demand in winter due to reflected solar radiation by light-colored roofs, can be reduced or eliminated by coating them with a #change of state# material, one that is solid and energy absorptive at one range of temperatures and liquid and transparent at a higher range of temperatures. Such a coated cool roof would have its reflectivity blocked while the building is warming up and its reflectivity exposed once the building reaches a desired, warmed up temperature. Methods/Materials A small, enclosed structure was insulated, its roof was coated with white paint to make it a cool roof, and a probe thermometer was inserted into the structure. Paraffin wax was sandwiched between thin glass panels, sized to cover the roof. A light source was placed above the cool roof and the temperature inside the enclosed structure was measured at 5 minute intervals until the temperature leveled off. This process was repeated with the cool roof covered with the enclosed wax panels. The results were then compared to determine if the glass panels improved the performance of the cool roof with respect to the winter penalty. Results The interior of the structure warmed up more slowly with the wax panels in place than without, and the interior temperature leveled off at a higher temperature with the panels in place than without them. Conclusions/Discussion From the data collected and the model used, it appears that a change of state material does not reduce or eliminate the #winter penalty# of a cool roof. In fact, it does the opposite. As the wax warmed and melted, it absorbed energy and so there was even less heat to pass along to the inside of the structure. Once the wax had melted, it seemed to act as a thermal blanket, increasing the heat inside the structure above that resulting from a cool roof alone. So, the addition of a change of state material layer over the cool roof appears to make the winter penalty worse, not better.	
Summary Statement This project was designed to test whether one of the few negative features of cool roofs could be fixed.	
Help Received Dad and friend helped assemble glass panels and structure; dad helped with some wording of project report.	