



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

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Project Title Paint Your Roof White: Fourier's Law and Calculating Energy Savings	
Abstract	
Objectives/Goals In July of 2009, Dr. Steven Chu, the current US Secretary of Energy and a Nobel prize-winning scientist, proposed something very simple to reduce energy cost and greenhouse gas emissions. He said "Paint your roof white". The objective is to make a simple energy cost calculator to prove or disprove Dr Chu's idea	
Methods/Materials I constructed a small database of roofing material data in Microsoft Excel using albedo, surface temperature measurements, and thermal conductivity collected from the Internet. I developed a simple roof model in Excel based on Fourier's Law " $Q = k.A.(DT/DX)$ ", to calculate the heat energy transfer for each of the various roofing materials (with and without insulation in the roof). For the cost calculations I used the energy rates from my parents' electric bill and used data from Pacific Gas and Electric to calculate CO2 emission levels	
Results The best performing roofing material was white concrete tile, albedo 73, while the worst was black asphalt shingle, albedo 5. For example, given a 2000 square foot roof, with R30 insulation, the estimated cost of offsetting the heat energy entering a house with white concrete tile would be approximately \$85/yr with a related CO2 emission of 168.9 lbs/yr. Compare that to the worst performing material, Black Asphalt Shingle, with an estimated annual cost of \$330/yr and a related CO2 emission of 662.5 lbs/yr	
Conclusions/Discussion I believe my findings support Dr Chu's original premise that painting your roof white is an easy and effective way to reduce energy costs and greenhouse gas emissions. My energy calculator is an effective tool for illustrating the correlation between roofing material albedo, energy costs and CO2 emissions for the homeowner, home builder, and even legislator or community leader interested in incentivizing "green" roofing products for home construction.	
Summary Statement The development of an energy calculator to compute the effect of surface albedo of roofing materials on energy costs and related CO2 emissions	
Help Received My Dad showed me how to program Microsoft Excel and how to do formatting in Microsoft Word	