Heat Transfer Calculation Blurb

To accurately measure the energy savings that can be realized using our actuating blind system, we first had to analyze the amount a room will heat up during the summer months when sunlight hits a south facing window directly. We focused on finding the simplified worst case scenario for heat transfer into the room.

 We started with energy data from Austin, Texas in 2010 in J/m2 recorded every hour. If we assumed that in the worst case scenario using a single pane glass window, 100% of this energy would pass through the window into the room. This energy can be assumed to contribute partially heating up the air in the room and partially to heating the walls, and of the energy the is absorbed by the walls, 100% of it would flow into the ambient air in the room through conduction. This is shown by the following equation.

$$∆T=\frac{Q}{Cpwall\*Awall\*twall+Cpair\*Vroom}$$

Where Cpwall and Cpair are the specific heat capacities of the wall and the air respectively, twall is the thickness of the wall, Awall is the area of the wall, and Vroom is the volume of the room. Q can be found by multiplying the average energy data by the surface area of the window through which the light is shining.

For a hypothetical room with dimensions 2m by 2m by 2m and a window of Area 2 m2, the temperature rise in the room for any given day in August 2012 would be 33 degrees Celsius.

For the situation with blinds situated on the outside of a house covering the window, we assume that none of the energy reaches the window, causing no increase in temperature and the room stays at a constant 22 degrees Celsius.

To relate this temperature difference to a realized savings in energy costs, we will, moving forward with our project, calculate the energy cost to run an air conditioner over the course of the day. Specifically the amount of energy that is needed to cool a room per degree Celsius, and lastly convert that to a dollar amount representing the saving that can be accumulated by using our blinds system.