

EES 405 Assignment 01. Heat Transfer Through Windows and Walls

Background.

A separate document, “Calculating Heat Loss and Solar Gain”, explains the theory behind this assignment and defines the **base case**.

A spreadsheet, “Heat Loss and Gain Calculator”, presents a convenient method for carrying out the calculations for the current assignment.

Problems. Do all calculations for *Hartford* for the *entire heating season*.

1. For the **base case**, calculate the heat loss through walls, windows, ceiling, and by infiltration. Also calculate the solar gain and the net heat loss.

Assume that the required heat will be supplied by burning heating oil in a 90% efficient heating system and calculate both the fuel cost and CO₂ emission associated with this fuel use.

2. Make the following changes to the base case and call the new case, the **code case** (keep it in your code case file):

Wall R-value → 17.0 Ceiling R-value → 38.0 K → 0.35 ACH

Calculate the heat loss through walls, windows, ceiling, and by infiltration. Also calculate the solar gain and the net heat loss.

Assume that the required heat will be supplied by burning heating oil in a 90% efficient heating system and calculate both the fuel cost and CO₂ emission associated with this fuel use.

Compare these results to the base case.

3. For the **code case** consider the effect on the heating bill and CO₂ emission of changing the windows to high tech windows with R-value equal to 4.0 and with transmission equal to 0.80.
4. Use these techniques to analyze the energy consumption and CO₂ emission for your house and to estimate the effect of changing windows, air change rate, and insulation values. Present these results in a brief report. We will discuss the economics of making these changes in the next assignment.

