Wall Heat Loss #3

# Problem

A single-story house in Anchorage, AK (HDD = 11,000) is 50 ft by 70 ft with an 8 ft high ceiling. There are six windows (R = 1) of identical size, 4 ft wide by 6 ft high. The roof is insulated to R-30. The walls consist of a layer of wood siding (R = 0.81), 2” of polyurethane board (R = 6.25 per inch), 4” of fiberglass (R = 3.70 per inch), and a layer of drywall (R = 0.45). Calculate the heat loss through the house (not counting the floor) for the season. (A good estimate for the area of the roof is 1.1 times the area of the walls, before you subtract out the area for the windows.)

# Solution

OK, for this problem, 3.15. We do, more or less, the same thing as the last house, except this house is in Anchorage, Alaska, where HDD happens to be 11,000 degree days. OK. Now we have to calculate here, heat loss through windows, through walls, and through roof, to calculate the total heat loss from the house, the same way that we have done before.

Heat loss through windows. We need the area of the windows first. So area of windows equal to-- Each window is 4 feet by 6 feet. So this is 24 square feet. So we have six of them, so the total area is 144 square feet. So heat loss equal to 144 feet square times HDDs 11,000 degree days times 24 hours in a day, and divided by r value, r value happens to be 1. So 1 feet square, degrees Fahrenheit, hour over BTU.

So you could cancel out some of these. We'll get BTUs heat loss. This is in a year. OK. So we would get this one to be approximately 38 million. 38,016,000 BTUs. This is per season or per year. OK. Now the second thing that we have to do is walls.

Here we have to calculate the area and also the r value. r value because it is a composite wall consisting of four layers. It has wood siding, which has an r value of 0.81 and 2 inches of polyurethane. And 2 times 6.25, so that is 12.5 r value. And we have a third layer 4 inches of fiberglass. 4 inches times 3.7, that's equal to 14.8.

And then we also have 1/2 inch drywall. And we know that the drywall r value is straight away 0.45, so now the total r value of this wall happens to be 28.56. OK. Now we have to calculate the area of the walls. Area of the walls we can calculate.

Let me draw a little picture here and show you. If we have-- Let's say this is the area and we have-- and this side is about 70, this side is 50. And we will have under there, 50 this side, and 70 this side. So total times this height is 8 feet. So the total area would be 2 times 120. 120 is 70 plus 50 times 2, because twice these values, times 8 feet is the height. So we get about 1,920 feet square.

Of course, this also have some windows, about six windows as we originally looked at, but at this point, we will take this as 1920 and subtracting windows from this. Windows is 144 feet square, so 1920 minus 144, would give us 1776 feet square.

OK, so now we have to calculate the area of-- Now, if we calculate the area of 1776 feet square times 11,000 times, this is degrees Fahrenheit days, times 24 hours per day, divided by-- we have 28.56. So the heat loss, in here, comes out to be 16,416,806 BTUs per year.

OK, now we have to calculate roof. Roof happens to be 1.1 times the area of the walls. Area of the walls was 1920 feet square. Again, we have to take this without the windows actual area of the walls, times 1.1, that happens to be 2112 feet square.

So heat loss 2112 feet square times 11,000 times 24, divided by-- r value of this is 30-- degrees Fahrenheit, h square, hour, over BTU. So this comes out to be it 18,585,600 BTUs per year.

So the total heat loss now, would be addition of all these three together. So that is, first we have, how much? If we look at, we have 38,016,000, so 38,016,000 plus 16,416,806 plus 18,585,600, so that is equal to 73, 019,000 BTUs. So that is the total heat loss from the house.