Fuel-energy savings by improving thermal insulationd

Heating and Cooling Degree-Days for Rockford Area:

$HDD := 6970 \cdot R \cdot day$ $CDD := 750 \cdot R \cdot day$ $Therm := 10^5 \cdot BTU$

$Aw := 22600 \cdot ft^2$ $Ar := 40692 \cdot ft^2$ ... wall and roof areas $a := 270 \cdot ft$ $b := 150 \cdot ft$ $c := 26 \cdot ft$

$SEER := 10 \cdot \frac{BTU}{W \cdot hr}$ Seasonal Energy Efficiency Ratio for A/C

Cost of electricity Cc and natural gas Ch in USD=$

$USD := 1$ $Cc := 0.1 \frac{USD}{kW \cdot hr}$ $Ch := 1 \cdot \frac{USD}{Therm}$ $\frac{Ch}{Cc} = 0.341$

Classical wall and roof insulation values: $Rw1 := 12 \cdot \frac{hr \cdot R \cdot ft^2}{BTU}$ $Rr1 := 19 \cdot \frac{hr \cdot R \cdot ft^2}{BTU}$

ThermalShell wall and roof insulation values: $Rw := 35 \cdot \frac{hr \cdot R \cdot ft^2}{BTU}$ $Rr := 30 \cdot \frac{hr \cdot R \cdot ft^2}{BTU}$

Differential heating loss saving:

$Qwh := Aw \cdot HDD \cdot \left(\frac{1}{Rw1} - \frac{1}{Rw} \right)$ $Qrh := Ar \cdot HDD \cdot \left(\frac{1}{Rr1} - \frac{1}{Rr} \right)$ $Qh := Qwh + Qrh$

$Qwh = 2.07 \times 10^8 BTU$ $Qrh = 1.314 \times 10^8 BTU$ $Qh = 3.384 \times 10^8 BTU$

$\boxed{Qh = 3.384 \times 10^3 Therm}$

Differential A/C cooling gain saving:

$Qwc := Aw \cdot CDD \cdot \left(\frac{1}{Rw1} - \frac{1}{Rw} \right)$ $Qrc := Ar \cdot CDD \cdot \left(\frac{1}{Rr1} - \frac{1}{Rr} \right)$ $Qc := Qwc + Qrc$

$Qwc = 2.228 \times 10^7 BTU$ $Qrc = 1.414 \times 10^7 BTU$ $Qc = 3.641 \times 10^7 BTU$

$Qc = 364.123 Therm$ $Qc = 1.067 \times 10^4 kW \cdot hr$

Savings in A/C electricity and Energy Cost savings:

$Ec := \frac{Qc}{SEER}$ $\boxed{Ec = 3.641 \times 10^3 kW \cdot hr}$ $Mc := Ec \cdot Cc$ $Mc = 364.123 USD$

$Mh := Qh \cdot Ch$ $Mh = 3.384 \times 10^3 USD$

TOTAL COST SAVING at current low energy prices (would be twice a year ago)

$Mhc := Mh + Mc$ $\boxed{Mhc = 3748.04 USD}$

$a \cdot b = 40.5 \times 10^3 ft^2$ $2 \cdot (a + b) \cdot c = 21.84 \times 10^3 ft^2$ $a \cdot b \cdot c = 1.053 \times 10^6 ft^3$