week8_TPletneva

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Task 1: Using the diagrams given in the presentation calculate how much (%) is the effect of applying different modifications (changing the gas, adding an extra pane, using a low emissivity coating) on the U value with respect to a benchmark case of double layer with air and no coating ? (keep the gap thickness to be 13 mm)

1) ***Benchmark case:***
   2 panes
   Air
   No coating
   U=2.8 (W/m^2)*K
   100%

2) 2 panes
   Argon
   No coating
   U=2.6 (W/m^2)*K
   ~8% Difference

3) 2 panes
   Air
   Coating +
   U=1.8 (W/m^2)*K
   ~ 36% Difference

4) 2 panes
   Argon
   Coating +
   U=1.5 (W/m^2)*K
   ~ 47% Difference

5) 3 panes
   Air
   No coating
   U=1.8 (W/m^2)*K
   ~ 36% Difference

6) 3 panes
   Air
   Coating +
   U=1 (W/m^2)*K
   ~65% Difference

7) 3 panes
   Argon
   No coating
   U=1.7 (W/m^2)*K
   ~ 40% Difference

8) 3 panes
   Argon
   Coating +
   U=0.8 (W/m^2)*K
   ~ 72% Difference

Task 2: Consider the house that we analyzed in the last two examples, calculate the heating and cooling load of the other windows which are fixed 14.4 m2 on the west, fixed 3.6 m2 on the south and an operable 3.6 m2 on the south (the same window and frame type). How much does the total value change if I change the frame of the window from wooden one to aluminum ?

deltaT_heating = 24.8 C
deltaT_cooling = 7.9 C
DR = 11.9 C

$U_{window,wood,FIXED}$=2.84 (W/m^2)*K

$U_{window,wood,OPER}$=2.87 (W/m^2)*K

$U_{window,aluminum,FIXED}$=3.61 (W/$m^2$)*K

$U_{window,aluminum,OPER}$=4.62 (W/m^2)*K

Heating:

Wood, West, Fixed, (A=14.4 m^2):

Aluminum, West, Fixed, (A=14.4 m^2):

Wood, West, Fixed, (A=14.4 m^2):

HF=U*delta_T=2.84*24.8= 70.4 W/m^2

Q=70.4*14.4=1014.2 W

Aluminum, West, Fixed, (A=14.4 m^2):

HF=U*delta_T=3.61*24.8= 89.5 W/m^2

Q=89.5*14.4=1288.8 W

HF difference - 19.1 W/m^2 Q difference - 274.6 W

Wood, South, Fixed, (A=3.6 m^2):

HF=2.84*24.8= 70.4 W/m^2

Q=70.4*3.6=253.44 W

Aluminum, South, Fixed, (A=3.6 m^2):

HF=3.61*24.8= 89.5 W/m^2

Q=89.5*3.6=322.2 W

HF difference - 19.1 W/m^2 Q difference - 68.8 W

Wood, South, Operable, (A=3.6 m^2):

HF=2.87*24.8= 71.2 W/m^2

Q=71.2*3.6=256.32 W

Aluminum, South, Operable, (A=3.6 m^2):

HF=3.61*24.8= 114.6 W/m^2

Q=114.6*3.6=412.56 W

HF difference - 43.3 W/m^2 Q difference - 156.24 W

<u>Cooling:</u>

Wood, West, Fixed, (A=14.4 m^2):

CF_fen=U(delta_T - 0.46 * DR)+PXI*SHGC*IAC*FF_s

CF_fen=2.84*(7.9-0.46*11.9)+747*0.54 *1*0.56=232.7

Q=232.7*14.4=3350.8 W

Aluminum, West, Fixed, (A=14.4 m^2):

CF_fen=U(delta_T - 0.46 * DR)+PXI*SHGC*IAC*FF_s

CF_fen=3.61*(7.9-0.46*11.9)+747*0.56*1 *0.56=243.03

Q=243.03*14.4=3499.6 W

CF_fen difference - 10.33 W/m^2 Q difference - 148.8 W

Wood, South, Fixed, (A=3.6 m^2):

CF_fen=2.84*(7.9-0.46*11.9)+557*0.54

Aluminum, South, Fixed, (A=3.6 m^2):

CF_fen=3.61*(7.9-0.46*11.9)+557*0.56*1

Wood, South, Fixed, (A=3.6 m^2):

CF_fen=2.84*(7.9-0.46*11.9)+557*0.54*1*0.47=148.26

Q=148.26*3.6=533.7 W

Aluminum, South, Fixed, (A=3.6 m^2):

CF_fen=3.61*(7.9-0.46*11.9)+557*0.56*1*0.47=155.37

Q=155.37*3.6=559.3 W

CF_fen difference - 7.11 W/m^2 Q difference - 25.6 W

Wood, South, Operable, (A=3.6 m^2):

CF_fen=2.87*(7.9-0.46*11.9)+557*0.46*1*0.47=127.39

Q=127.39*3.6=458.6 W

Aluminum, South, Operable, (A=3.6 m^2):

CF_fen=4.62*(7.9-0.46*11.9)+557*0.55*1*0.47=155.2

Q=155.2*3.6=558.7 W

CF_fen difference - 27.81 W/m^2 Q difference - 100.1 W