WEEK8_KKAZAN

16 Aralık 2019 Pazartesi
16:25

QUESTION 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 respect to a benchmark case of double layer with air and no coating (keep the gap thickness to be 13

	BENCHMARK	1	2	3
gap	12,7 mm	13 mm	13 mm	13 mm
N^0 PANE	2	3	2	2
GAS	Air	AİR	ARGON	Air
U_{FACTOR}	1,92 W/ m^2	1,84 W/ m^2	1,67W/ m^2	2,76 W/ m^2
%	70 %	66%	60%	100%

QUESTION 2:

Part I:

- heat absorbing , double layers, wooden frame ;
- East side surface area :14.4 m^2 , fixed window
- West side surface area :14.4 m^2, fixed window
- North side surface area :3,6 m^2, fixed window
- South side surface area :3,6 m^2, fixed window

East Heating

- Winter U : 0,438 W/m^2
- Summer U : 0,435 W/m^2

Calculate the heating and cooling

$U_{window\ east}$ = 2,84 W/M^2k

$HF_{windoweast} = U_{window\ east} \times \Delta T_{heating}$ = 2,84 * 24,8 =70,4W/m^2

$Q_{windoweast} = HF_{windoweast} \times A_{windoweast}$ = 70,4 * 14,4 = 1014,2 W

East Cooling

CF_{fen} = U (ΔT - 0,46 DR) +PXI * SHGC * IAC * FF_3

$PXI_{windoweast} = E_D + E_d$ = 559 + 188 =747
SHGC= 0,54 ;

NO internal shading so IAC =1
From the table for easten window of a detached hourse FFs = 0,31

$CF_{windoweast\ Irradiation\ Part}$ = PXI * SHGC * IAC * FF_S = 747*0,54*1*0,31=125,1

$CF_{windoweast\ heat\ TransferPart}$ = $U_{window\ east}$ (ΔT - 0,46 DR) = 2,84 (7,9-0,46 *11,9)= 6,9 W/m^2

$CF_{windoweast}$ = $CF_{windoweastheatTransferPart}$ + $CF_{windoweast\ Irradiation\ Part}$ = 6,9 +125,1 = 132 W/m^2

$Q_{windoweast}$ = $CF_{windoweast}$ x $A_{windoweast}$ = 132* 14,4 = 1.900,8 W

West Heating

$U_{window\ west}$ = 2,84 W/M^2k

$HF_{window\ west}$ = $U_{window\ east}$ X $\Delta T_{heating}$ = 2,84 * 24,8 =70,4W/m^2

$Q_{window\ west}$ = $HF_{window\ west}$ X $A_{window\ west}$ = 70,4 * 14,4 = 1014,2 W

West Cooling

CF_{fen} = U (ΔT - 0,46 DR) +PXI * SHGC * IAC * FF_3

$PXI_{window\ west}$ = E_D + E_d = 559 + 188 =747
SHGC= 0,54
NO internal shading so IAC =1
From the table for western window of a detached hourse FFs = 0,56

$CF_{window\ west\ Irradiation\ Part}$ = PXI * SHGC * IAC * FF_S = 747*0,54*1*0,56=225,9

$CF_{window\ west\ heat\ TransferPart}$ = $U_{window\ west}$ (ΔT - 0,46 DR) = 2,84 (7,9-0,46 *11,9)= 6,9 W/m^2

$CF_{window\ west}$ = $CF_{window\ west\ heat\ TransferPart}$ + $CF_{window\ west\ Irradiation\ Part}$ = 6,9 +225,9 = 232,8 W/m^2

$Q_{window\ west}$ = $CF_{window\ west}$ x $A_{window\ west}$ = 232,8*14,4= 3.352,32 W

North Heating

$U_{window\ north}$ = 2,84 W/M^2k

$HF_{window\ north}$ = $U_{window\ north}$ X $\Delta T_{heating}$ = 2,84 * 24,8 =70,4W/m^2

$Q_{window\ north}$= $HF_{window\ north}$ X $A_{window\ north}$ = 70,4 * 3,6 = 253,44 W

North Cooling

CF_{fen} = U (ΔT - 0,46 DR) +PXI * SHGC * IAC * FF_3

$PXI_{window\ north} = E_D + E_d = 85 + 76 = 161$
SHGC= 0,54
NO internal shading so IAC =1
From the table for northern window of a detached hourse FFs = 0,44

$CF_{window\ north\ Irradiation\ Part} = PXI * SHGC * IAC * FF_S = 161*0,54*1*0,44 = 38,25$

$Cf_{window\ north\ heat\ TransferPart} = U_{window\ north} (\Delta T - 0,46\ DR) = 2,84\ (7,9-0,46 *11,9) =$ 6,9 W/m²

$Cf_{window\ north} = Cf_{window\ north\ heat\ TransferPart} + Cf_{window\ north\ Irradiation\ Part} =$ 6,9 +38,25=45,15 W/m²

$Q_{window\ north} = CF_{window\ north} \times A_{window\ north} = 45,15*3,6 =$ 162,54 W

South Heating

$U_{window\ south} = 2,87\ W/M^2K$

$HF_{window\ south} = U_{window\ south} \times \Delta T_{heating} = 2,87* 24,8 = 71,2\ W/m^2$

$Q_{window\ south} = HF_{window\ south} \times A_{window\ south} = 71,2 * 3,6 =$ 256,32 W

South Cooling

$CF_{fen} = U (\Delta T - 0,46\ DR) + PXI * SHGC * IAC * FF_3$

$PXI_{window\ south} = E_D + E_d = 348 + 209 = 557$
SHGC= 0,46
NO internal shading so IAC =1
From the table for southern window of a detached hourse $FF_s = 0,47$

$CF_{window\ north\ Irradiation\ Part} = PXI * SHGC * IAC * FF_S = 557*0,46*1*0,47 =$ 120,5

$Cf_{window\ north\ heat\ TransferPart} = U_{window\ north} (\Delta T - 0,46\ DR) = 2,84\ (7,9-0,46 *11,9) =$ 6,9 W/m²

$Cf_{window\ north} = Cf_{window\ north\ heat\ TransferPart} + Cf_{window\ north\ Irradiation\ Part} =$ 6,9 +120,5=127,4 W/m²

$Q_{window\ north} = CF_{window\ north} \times A_{window\ north} = 127,4*3,6 =$ 458,64 W

- Winter U : 0,438 W/m²
- Summer U : 0,435 W/m²

- Total q window cooling = 458,64 +162,54 +3352,32 +1900,8 = 5874,3 W
- Total q window heating =256,32 +253,44 +1014,2+1014,2= 2281,84 W

Calculate the heating and cooling loads.

Part I:

- heat absorbing , double layers, alıminum frame(U and SHGC VALUES CHANGES) ;
- East side surface area :14.4 m^2, fixed window
- West side surface area :14.4 m^2, fixed window
- North side surface area :3,6 m^2, fixed window
- South side surface area :3,6 m^2, operable window

East Heating

$U_{window\ east}$ = 3,61 W/M^2K

$HF_{windoweast} = U_{window\ east} \times \Delta T_{heating}$ = 3,61 * 24,8=89,5 W/m^2

$Q_{windoweast} = HF_{windoweast} \times A_{windoweast}$ = 89,5 * 14,4=1288,8 W

East Cooling

CF_{fen} = U (ΔT - 0,46 DR) +PXI * SHGC * IAC * FF_3

$PXI_{windoweast} = E_D + E_d$ = 559 + 188 =747
SHGC= 0,56
NO internal shading so IAC =1
From the table for easten window of a detached hourse FFs = 0,31

$CF_{windoweast\ Irradiation\ Part}$ = PXI * SHGC * IAC * FF_S = 747*0,56*1*0,31=129,6

$CF_{windoweast\ heat\ TransferPart} = U_{window\ east}$ (ΔT - 0,46 DR) = 3,61*(7,9-(0,46 *11,9))=8,7 W/m^2

$CF_{windoweast} = CF_{windoweastheatTransferPart} + CF_{windoweast\ Irradiation\ Part}$ = 8,7+129,6= 138,3 W/m^2

$Q_{windoweast} = CF_{windoweast} \times A_{windoweast}$ = 138,3*14,4=1.991,52 W

West Heating

$U_{window\ west}$ = 3,61 W/M^2k

$HF_{window\ west} = U_{window\ east} \times \Delta T_{heating}$ = 3,61 * 24,8 =89,5W/m^2

$Q_{window\ west} = HF_{window\ west} \times A_{window\ west}$ =89,5 * 14,4 = 1288,8 W

West Cooling

CF_{fen} = U (ΔT - 0,46 DR) +PXI * SHGC * IAC * FF_3

$PXI_{window\ west} = E_D + E_d$ = 559 + 188 =747
SHGC= 0,56

NO internal shading so IAC =1
From the table for western window of a detached hourse FFs = 0,56

$CF_{window\ west\ Irradiation\ Part}$ = PXI * SHGC * IAC * FF_S = 747*0,56*1*0,56=234,3

$CF_{window\ west\ heat\ TransferPart}$ = $U_{window\ west}$ (ΔT - 0,46 DR) = 3,61* (7,9-(0,46 *11,9))=8,7 W/m^2

$CF_{window\ west}$ = $CF_{window\ west\ heat\ TransferPart}$ + $CF_{window\ west\ Irradiation\ Part}$ = 8,7 +234,3=243 W/m^2

$Q_{window\ west}$ = $CF_{window\ west}$ x $A_{window\ west}$ = 243*14,4=3.499,2 W

North Heating

$U_{window\ north}$ =3,61 W/M^2k

$HF_{window\ north}$ = $U_{window\ north}$ X $\Delta T_{heating}$ = 3,61 * 24,8=89,5 W/m^2

$Q_{window\ north}$= $HF_{window\ north}$ X $A_{window\ north}$ = 89,5 * 3,6= 322,2 W

North Cooling

CF_{fen} = U (ΔT - 0,46 DR) +PXI * SHGC * IAC * FF_3

$PXI_{window\ north}$ = E_D + E_d =85 + 76 =161
SHGC= 0,56
NO internal shading so IAC =1
From the table for northern window of a detached hourse FFs = 0,44

$CF_{window\ north\ Irradiation\ Part}$ = PXI * SHGC * IAC * FF_S = 161*0,56*1*0,44=39,7

$Cf_{window\ north\ heat\ TransferPart}$ = $U_{window\ north}$ (ΔT - 0,46 DR) = 3,61* (7,9-(0,46 *11,9))=8,7 W/m^2

$Cf_{window\ north}$ = $Cf_{window\ north\ heat\ TransferPart}$ + $Cf_{window\ north\ Irradiation\ Part}$ = 8,7+39,7=48,4 W/m^2

$Q_{window\ north}$ = $CF_{window\ north}$ x $A_{window\ north}$ = 48,4*3,6=174,24 W

South Heating

$U_{window\ south}$ = 4,62W/M^2K

$HF_{window\ south}$ = $U_{window\ south}$ X $\Delta T_{heating}$ = 4,62* 24,8=114,5 W/m^2

$Q_{window\ south}$= $HF_{window\ south}$ X $A_{window\ south}$ = 114,5*3,6=412,2 W

South Cooling

CF_{fen} = U (ΔT - 0,46 DR) +PXI * SHGC * IAC * FF_3

$PXI_{window\ south}$ = E_D + E_d = 348 +209=557
SHGC= 0,55
NO internal shading so IAC =1
From the table for southern window of a detached hourse FF_s = 0,47

$CF_{window\ north\ Irradiation\ Part}$ = PXI * SHGC * IAC * FF_S = 557*0,55*1*0,47=144

$Cf_{window\ north\ heat\ TransferPart}$ = $U_{window\ north}$ (ΔT - 0,46 DR) =4,62* (7,9-(0,46 *11,9))=11 W/m^2

$Cf_{window\ north}$ = $Cf_{window\ north\ heat\ TransferPart}$ + $Cf_{window\ north\ Irradiation\ Part}$ =11 +144=155 W/m^2

$Q_{window\ north}$ = $CF_{window\ north}$ x $A_{window\ north}$ = 155*3,6=558 W

- Total q window cooling = 558+174,24+3499,2+1991,52=6222,96 W
- Total q window heating = 1288,8+1288,8+322,2+256,32=3156,12 W

CONCULUTION:
According to result we can say that wood is better material than aluminium. It has better resistance in cooling and aspects.