Assignment 8

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 with respect to a benchmark case of double layer with air and no coating ? (keep the gap thickenss to be 13 mm).

Type	U factor	%
2 Panes with air	2,8 W/m^2	
2 Panes with gas (krypton)	2,6 W/m^2	7,14%
2 Panes with gas and low emissivity coatng	1,4 W/m2	50%
2 Panes with air and low emissivity coating	1,8 W/m2	35,71%
3 Panes with air	1,8 W/m2	35,71%
3 Panes with gas (krypton)	1,6 W/m2	42,85%
3 Panes with gas and coating	0,8 W/m2	71,42%
3 Panes with air and coating	1,1 W/m2	60,71%

Question 2

Consider the house that we analysed in the alst 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 aluminium ?

COOLING

West window fixed (wooden)

$CF_{ht} = U^* (\Delta T_{cooling} - 0.46\ DR) = 2.84 * (7.9 - 0.46 * 11.9) = 6.9 W/m^2$

$CF_{ip} = PXI \times SHGC \times IAC \times FF_s = 747 * 0.54 * 1 * 0.56 = 217.82\ W/m^2$

CF total = 224.72 W/m2

$Q = CF_{total} * A$

Q=224.72 * 14.4 = 3236W

West window fixed (aluminium)

$CF_{ht} = U^* (\Delta T_{cooling} - 0.46\ DR) = 3.61 * (7.9 - 0.46 * 11.9) = 8.75 W/m^2$

$CF_{ip} = PXI \times SHGC \times IAC \times FFs = 747 * 0.56 * 1 * 0.56 = 234.25\ W/m2$

$CF_{total} = 243\ W/m2$

$Q = CF_{total} * A$

Q=243 * 14.4 = 3500 W

$Q_2 - Q_1 = 264\ W$

South window fixed (wooden)

$CF_{ht} = U^* (\Delta Tcooling - 0.46\ DR) = 2.84 * (7.9 - 0.46 * 11.9) = 6.9 W/m2$

$CF_{ip} = PXI \times SHGC \times IAC \times FFs = 557 * 0.54 * 1 * 0.47 = 141.36\ W/m2$

$CF_{total} = 148.26\ W/m2$

$Q = CF_{total} * A$

Q = 148,26 * 3.6

Q= 533.73 W

South window fixed (aluminium)

$CF_{ht} = U^* (\Delta T_{cooling} - 0.46\ DR) = 3.61 * (7.9 - 0.46 * 11.9) = 8.75 W/m2$

$CF_{ip} = PXI \times SHGC \times IAC \times FFs = 557 * 0.56 * 1 * 0.47 = 146.6\ W/m2$

$CF_{total} = 155.35/m2$

$Q = CF_{total} * A$

Q = 155.35 * 3.6

Q= 559.2 W Q2-Q1= 25.47 W

South window operable (wooden)

$CF_{ht} = U^* (\Delta T_{cooling} - 0.46\ DR) = 2.87 * (7.9 - 0.46 * 11.9) = 6.96 W/m2$

$CF_{ip} = PXI \times SHGC \times IAC \times FFs = 557 * 0.46 * 1 * 0.47 = 120.4\ W/m2$

$CF_{total} = 127.4\ W/m2$

$Q = CF_{total} * A$

Q = 127.4 * 3.6

Q= 458.64 W

South window operable (aluminium)

$CF_{ht} = U^* (\Delta T_{cooling} - 0.46\ DR) = 4.62 * (7.9 - 0.46 * 11.9) = 11.2 W/m2$

$CF_{ip} = PXI \times SHGC \times IAC \times FFs = 557 * 0.55 * 1 * 0.47 = 144\ W/m2$

$CF_{total} = 155.2/m2$

$Q = CF_{total} * A$

Q = 155.2 * 3.6

Q= 558.72 W Q2-Q1= 100.08W

HEATING

West window fixed (wooden)

$HF = U * \Delta T_{heating} = 2.84 * 24.8 = 70.4\ W/m^2$

Q = HF * A

Q = 70.4 * 14.4 = 1014.2 W

West window fixed (aluminum)

$HF = U * \Delta T_{heating} = 3.61 * 24.8 = 89.52\ W/m2$

Q = HF * A

Q = 89.52 * 14.4 = 1289.2 W

Q_2-Q_1 = 275W

South window fixed (wooden)

HF = U * $\Delta_{Theating}$ = 2.84 * 24.8 = 70.4 W/m2

Q = HF * A

Q = 70.4 * 3.6 = 253.4 W

South window fixed (aluminium)

HF = U * $\Delta T_{heating}$ = 3.61 * 24.8 = 89.52 W/m2

Q = HF * A

Q = 89.52 * 3.6 = 322.3 W

Q_2-Q_1 = 68.9W

South window operable (wooden)

HF = U * $\Delta T_{heating}$ = 2.87* 24.8 = 71.87 W/m2

Q = HF * A

Q = 71.87 * 3.6 = 256.2 W

South window operable (aluminium)

HF = U * $\Delta T_{heating}$ = 4.62 * 24.8 = 114.57 W/m2

Q = HF * A

Q = 114.57 * 3.6 = 412.45 W

Q_2-Q_1 = 156.26W