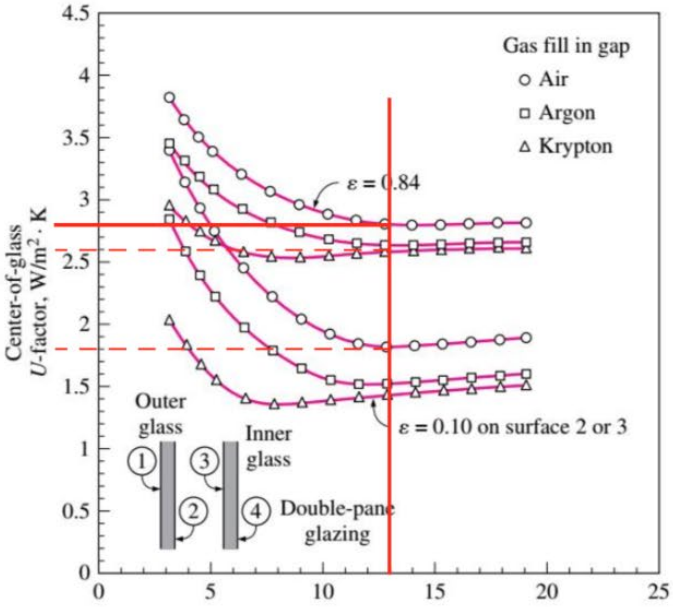
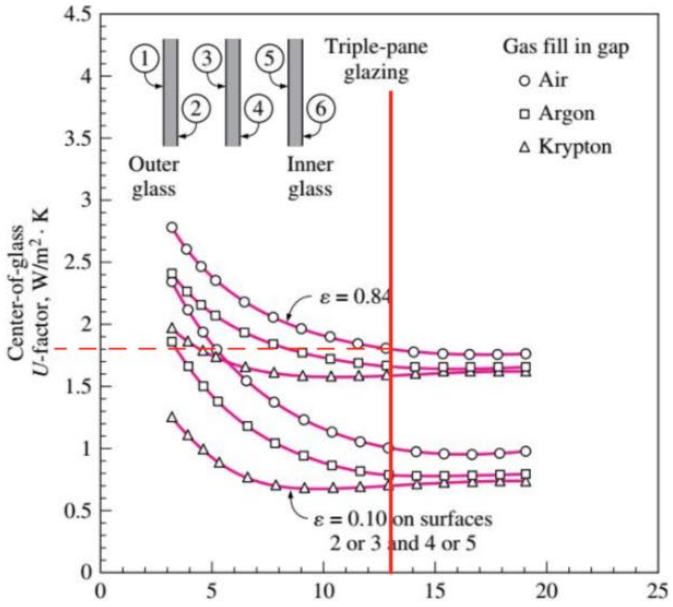
Task 1

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 in mind the gap thickness to be 13 mm)





2 parallel planes	u- value (W/m2)	Difference (W/m2)	percentage
w/air	2.8	0	0%
w/argon	2.65	0.15	5.36%
w/krypton	2.6	0.20	7.14%

3 parallel planes	u- value (W/m2)	Difference (W/m2)	percentage
w/air	1.8	1	35.7%
w/argon	1.7	1.1	39.2%
w/krypton	1.6	1.20	42.8

Task 2

Considering 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 sqm on the west, fixed 3.6 sqm on the south and an operable 3.6 sqm 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?

PIACENZA, Italy WMO#: **160840**

Lat: **44.92N** Long: **9.73E** Elev: **138** StdP: **99.68** Time Zone: **1.00 (EUW)** Period: **89-10** WBAN: **99999**

Annual Heating and Humidification Design Conditions

Coldest Month	Heating DB		Humidification DP/MCDB and HR						Coldest month WS/MCDB				MCWS/PCWD to 99.6% DB	
	99.6%	99%	99.6%			99%			0.4%		1%			
			DP	HR	MCDB	DP	HR	MCDB	WS	MCDB	WS	MCDB	MCWS	PCWD
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)
1	-6.2	-4.8	-11.6	1.4	3.1	-8.8	1.8	1.8	8.8	5.6	7.7	6.2	2.1	250

(1)

Annual Cooling, Dehumidification, and Enthalpy Design Conditions

Hottest Month	Hottest Month DB Range	Cooling DB/MCWB						Evaporation WB/MCDB						MCWS/PCWD to 0.4% DB	
		0.4%		1%		2%		0.4%		1%		2%			
		DB	MCWB	DB	MCWB	DB	MCWB	WB	MCDB	WB	MCDB	WB	MCDB	MCWS	PCWD
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)
8	11.9	33.1	22.7	31.9	22.4	30.3	21.8	24.6	30.2	23.7	29.2	22.9	28.3	2.4	90

(2)

DTcooling=31.9-24=7.9 C

DTheating = 20 +4.8 =24.8 C

DR=11.9C

- <u>WEST WINDOW: FIXED</u>
- <u>COOLING LOAD: WOOD FRAME:</u>

  Qwindoww= A*CFwindoww

  A=14m2

  CFwindoww=CFwindowwheattransfer +CFwindowwirradiation

  CFwindoww= U(DT – 0.46DR)+ PXI*SHGC*IAC*FFs

  CFwindowwht=2.84(7.9-(0.46*11.9)=6.89 w/m2

  CFwindowwir=PXI*SHGC*IAC*FFs

  PXI=ED- Ed=559+188=747

  CFwindowwir=747*0.54*1*0.56=225.89w/m2

CFwindoww=CF windowht + CF windowir
=6.89+225.89=232.78 w/m2
Qwindow= A*CF=3352.07W

- COOLING LOAD: AMLUMINUM FRAME
  CFwindowwht= 3.61(7.9-(0.46*11.9)=8.76w/m2
  CFwindowir=747*0.56.1.0.56=2334.26w/m2
  CFwindoww=8.76+234.26=243.02W/m2
  qwindoww=A*CFwindow= 3499.7W

- HEATING LOAD: WOOD FRAME
  HFwindoww=Uwindoww*DTheating
  =2.84*24.8=70.43W/m2
  q=14.4*70.43=1.14.22W

- HEATING LOAD: ALUMINUM FRAME
  HF=3.61*24.8=89.53 W/m2
  q=14.4*89.53=1289.20W

Difference: the cooling load=147.4W
the heating load= 274.98 W

- SOUTH WINDOW: FIXED
- COOLING : WOOD
  CFws-ht=2.84(7.9-(0.46*11.9)=6.89 w/m2
  CFws-ir=557*0.54*0.47=141.37 w/m2
  CFws=6.89+141.37=148.26 w/m2
  q=3.6*148.26=533.75 w

- COOLING ALUMINUM FRAME:
  CFws-ht=3.61(7.9-(0.46*11.9)=8.76w/m2
  CFws-ir=557*0.56*1*0.4=146.60 w/m2
  CFws=8.76+146.60+155.36 w/m2
  qws=3.6*155.36=559w

- HEATING WOOD FRAME
  HFws=2.84*24.8=70.43w/m2
  qws=3.6*70.43=253w

- HEATING ALUMINUM FRAME:
  HFws=3.61*24.8=89.53 w/m2
  qws=3.6*89.53=322.31