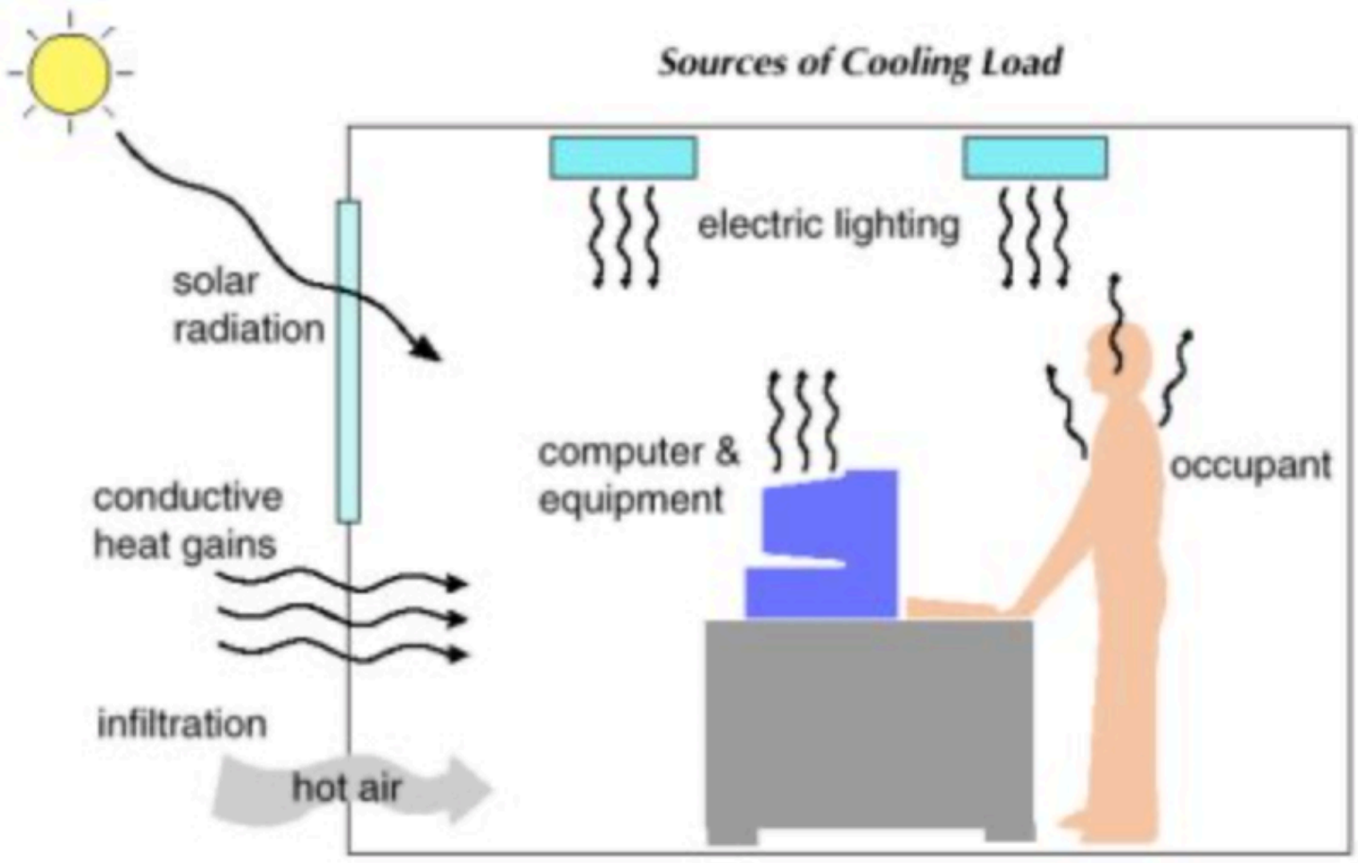
ภาระการทำความเย็นในอาคาร

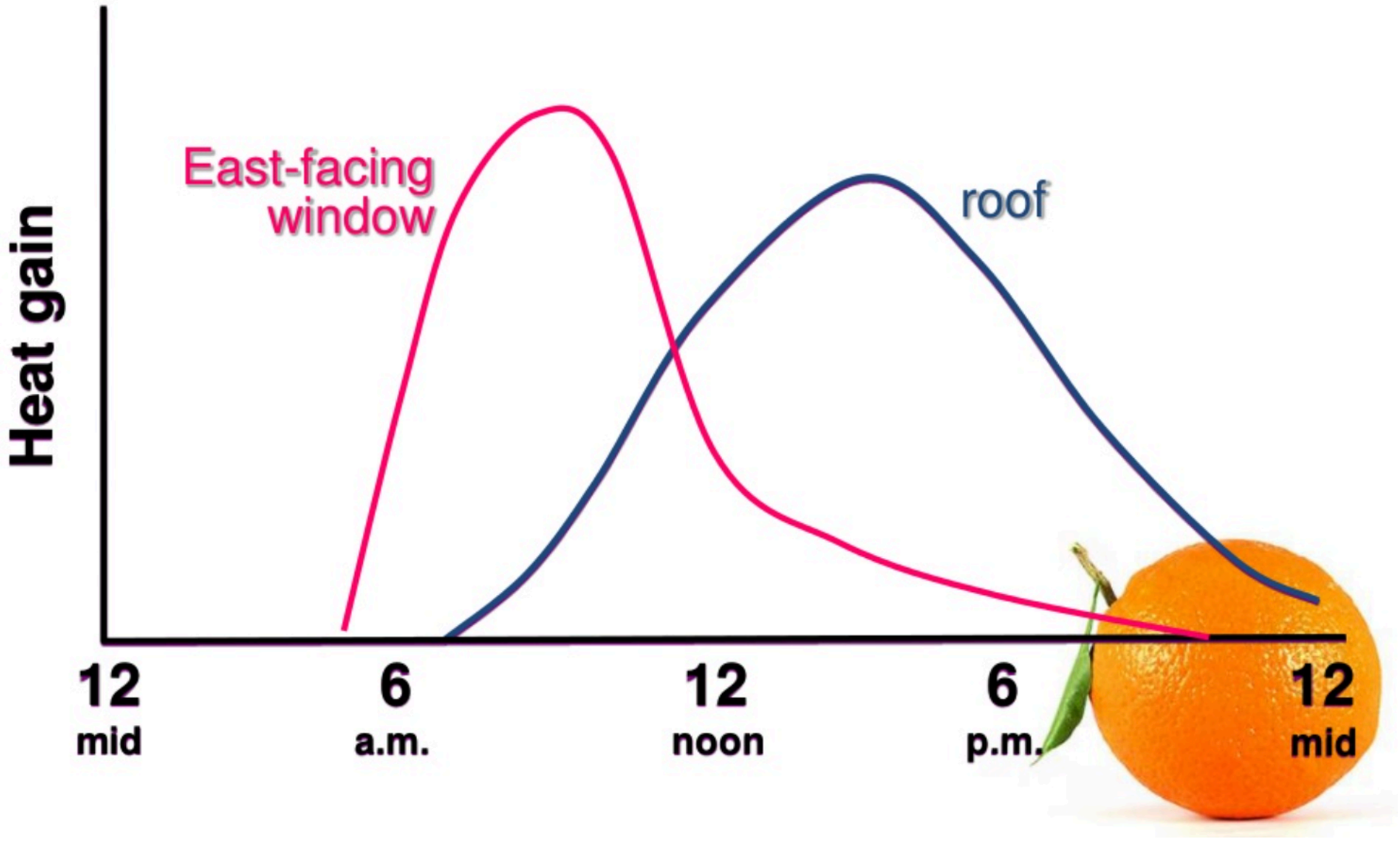
Cooling Load



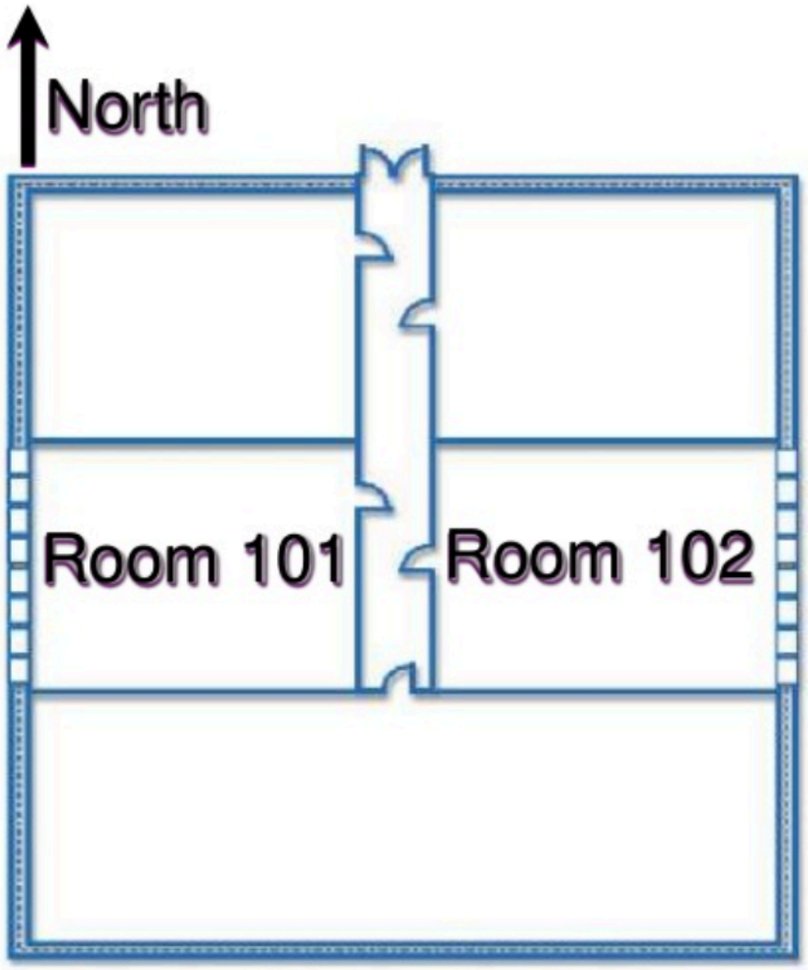
ภาระการทำความเย็นในห้อง

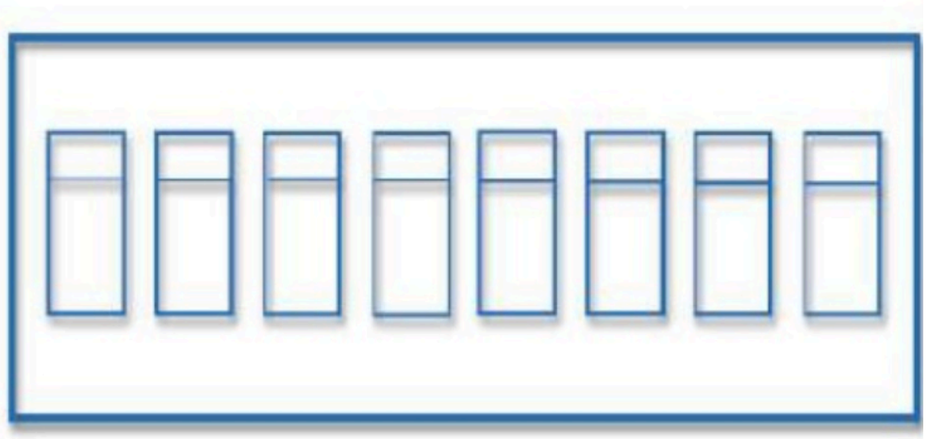
ภายนอก + ภายใน

Time of Peak Cooling Load



Example Office Space (Room 101)





Elevation view (Room 101)

Conduction through a Shaded Wall

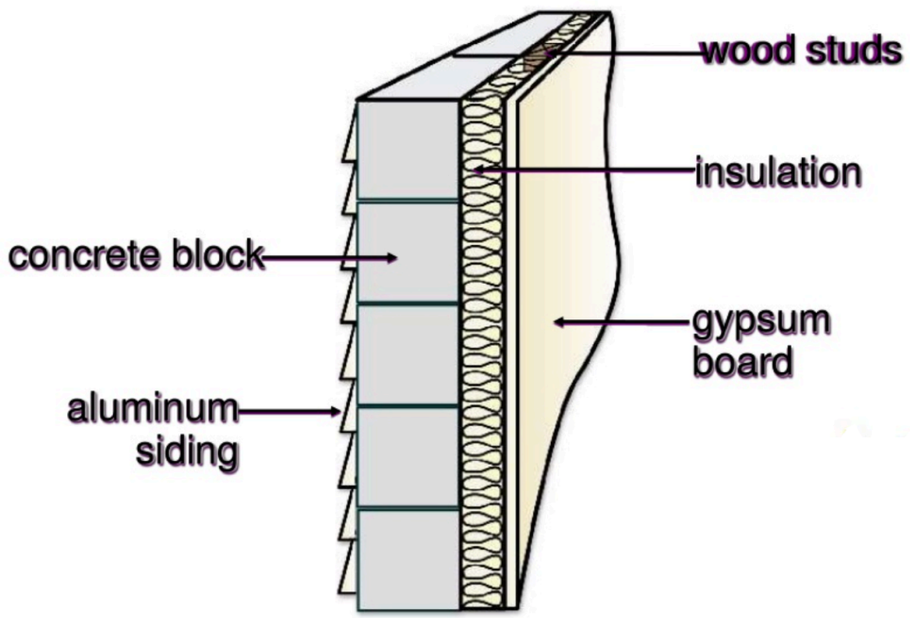
$$Q = U \times A \times \Delta T$$

U – Overall heat transfer coefficient of the surface

A – Area of the surface

Δ T – Dry bulb temperature difference across the surface

U-factor



$$R_{wall} = \frac{L}{kA}$$ ซึ่งมีหน่วยเป็น °C/W

$$R_{conv} = \frac{1}{hA_s}$$ ซึ่งมีหน่วยเป็น °C/W

Clip slide

U-factor for Example Wall

thermal resistance (R)

$R_{outdoor\text{-}air\ film}$	0.25	[0.04]
R_{siding}	0.61	[0.11]
$R_{concrete\ block}$	2.00	[0.35]
$R_{insulation}$	13.00	[2.29]
$R_{gypsum\ board}$	0.45	[0.08]
$R_{indoor\text{-}air\ film}$	0.68	[0.12]
R_{total}	16.99	[2.99]

$$U = \frac{1}{R_{total}}$$

$U = 0.06\ Btu/hr \cdot ft^2 \cdot °F$

$[\ U = 0.33\ W/m^2 \cdot °K\ ]$

Material	**Thermal conductivity (W/m K)**
Copper (pure)	399
Gold (pure)	317
Aluminum (pure)	237
Iron (pure)	80.2
Carbon steel (1 %)	43
Stainless Steel (18/8)	15.1
Glass	0.81
Plastics	0.2 – 0.3
Wood (shredded/cemented)	0.087
Cork	0.039
Water (liquid)	0.6
Ethylene glycol (liquid)	0.26
Hydrogen (gas)	0.18
Benzene (liquid)	0.159
Air	0.026

Material	Thermal conductivity (W/mK)
Quartz crystal	9.10
Quartz glass	1.27
Granite	1.72-3.85
Calcium carbonate	3.80
Marble	2.08-2.94
Limestone	2.22
Ice	2.22
Sandstone	2.00
Dolomite	1.72
Slate	1.49
Mica	0.59
Steel	16-43
Concrete	0.10-1.70

Type of fluid and flow	**Convective heat transfer coefficient h_c, (W/m^2 K)**
Air, free convection	6 – 30
Water, free convection	20 – 100
Air or superheated steam, forced convection	30 – 300
Oil, forced convection	60 – 1800
Water, forced convection	300 – 18000
Synthetic refrigerants, boiling	500 - 3000
Water, boiling	3000 – 60000
Synthetic refrigerants, condensing	1500 - 5000
Steam, condensing	6000 – 120000

Solar Heat Gain through Glass

ตารางที่ 9 ตารางค่า *SCL* สำหรับกระจก (W/m^2) สำหรับข้อมูลภูมิอากาศแบบแรก

Glass Face	(Zone type A) Hour																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	6	5	4	4	3	30	72	87	102	110	114	115	119	119	117	115	104	59	24	18	13	10	8	7
NE	6	5	5	4	3	82	160	297	306	256	181	140	130	118	103	84	60	35	21	16	13	10	9	7
E	7	6	5	4	4	92	181	353	373	316	207	149	135	122	107	87	62	37	22	17	14	11	9	8
SE	6	5	4	4	3	53	121	221	240	210	156	129	121	112	99	81	57	33	19	14	11	9	8	7
S	4	4	3	3	2	15	51	63	85	100	106	109	112	108	96	78	54	30	16	12	9	7	6	5
SW	12	10	8	7	6	18	51	62	81	94	102	112	167	236	293	312	268	130	53	38	28	21	17	14
W	18	15	13	11	9	21	54	64	83	95	103	119	229	357	461	513	467	228	88	62	45	35	27	22
NW	15	13	11	9	8	20	53	63	82	96	104	118	193	289	379	432	401	199	76	53	39	30	23	19
HOR	22	19	17	15	13	31	124	246	383	498	565	619	632	565	478	344	186	100	66	51	42	35	30	25

$$\mathbf{Q = A \times SC \times SCL}$$

Where,

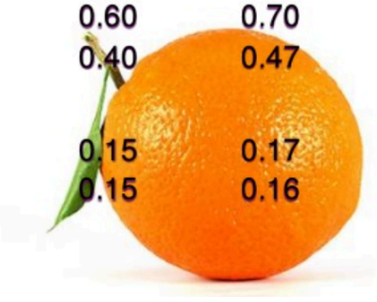
SC – Shading Coefficient

SCL – Solar Cooling Load Factor

Shading Coefficient (SC)

	shading coefficient at normal incidence: aluminum frame		other frames	
	operable	fixed	operable	fixed
uncoated single glazing				
1/4 in. [6.4 mm] clear	0.82	0.85	0.69	0.82
1/4 in. [6.4 mm] green	0.59	0.61	0.49	0.59
reflective single glazing				
1/4 in. [6.4 mm] SS on clear	0.26	0.28	0.22	0.25
1/4 in. [6.4 mm] SS on green	0.26	0.28	0.22	0.25
uncoated double glazing				
1/4 in. [6.4 mm] clear - clear	0.70	0.74	0.60	0.70
1/4 in. [6.4 mm] green - clear	0.48	0.49	0.40	0.47
reflective double glazing				
1/4 in. [6.4 mm] SS on clear - clear	0.20	0.18	0.15	0.17
1/4 in. [6.4 mm] SS on green - clear	0.18	0.18	0.15	0.16

SS = stainless-steel reflective coating



Calculate the heat generated by occupants, allow 600 BTU per person.

Occupant BTU = number of people x 600

Enter power in BTU/hr: 600 BTU/hr

Convert Reset

Kilowatts result: 0.1758426232 kW

Heat Gain from Lighting

$$Q = \text{watts} \times \text{Ballast factor} \times \text{CLF}$$

1.0

Ballast factor = 1.2 for fluorescent lights

Ballast factor = 1.0 for incandescent lights