FULL AIR SYSTEM SIZING

A.A 2024/25

Case Study 3						
Building data						
	Location	Copenhagen, Denmark				
	Building type	Office Building				
Geometrical data						
	Total floor area (m^2)	1057.3				
	Number of floors	1				
	Window locations	Located on external walls				
	Shading surfaces	-				
	Height (m)	2.7				
	Windows size (m)	1.8 x 1.5				
Building Envelope						
	External wall	**s [m]**	**λ [W/(m·K)]**	**cp [J/kg·K)]**	**ρ [kg/m^3]**	**U [W/(m^2·K)]**
	Internal plaster	0.02	0.7	1000	1400	**0.19**
	Rock whool	0.16	0.036	1000	90	
	Semi hollow bricks	0.25	0.4	1000	1000	
	External plaster	0.02	0.9	1000	1800	
	Internal wall	**s [m]**	**λ [W/(m·K)]**	**cp [J/kg·K)]**	**ρ [kg/m^3]**	**U [W/(m^2·K)]**
	Internal plaster	0.01	0.7	1000	1400	**1.58**
	Concrete panel	0.2	0.58	1000	1400	
	Internal plaster	0.01	0.7	1000	1400	
	Roof	**s [m]**	**λ [W/(m·K)]**	**cp [J/kg·K)]**	**ρ [kg/m^3]**	**U [W/(m^2·K)]**
	Built-up roofing	0.01	0.16	1460	1120	**0.31**
	Fiberboard sheathing	0.01	0.07	1300	400	
	Insulation board	0.08	0.03	1210	43	
	Lightweight concrete	0.10	0.53	840	1280	
	Ground contact floor	**s [m]**	**λ [W/(m·K)]**	**cp [J/kg·K)]**	**ρ [kg/m^3]**	**U [W/(m^2·K)]**
	Porcelain floor	0.015	1.47	1000	1700	**0.20**
	Cement mortar	0.03	1.4	1000	2000	
	Lightened concrete	0.1	0.33	1000	1200	
	Screed	0.2	1.2	1000	1700	
	Ueq ground losses	0.15	0.035	1000	30	
	Windows	**Visible trasmittance**		**Solar heat gain**		**U [W/(m^2·K)]**
	Single glazing	0.7		0.7		**1.2**

In the following picture the floor plan of the office building is presented:

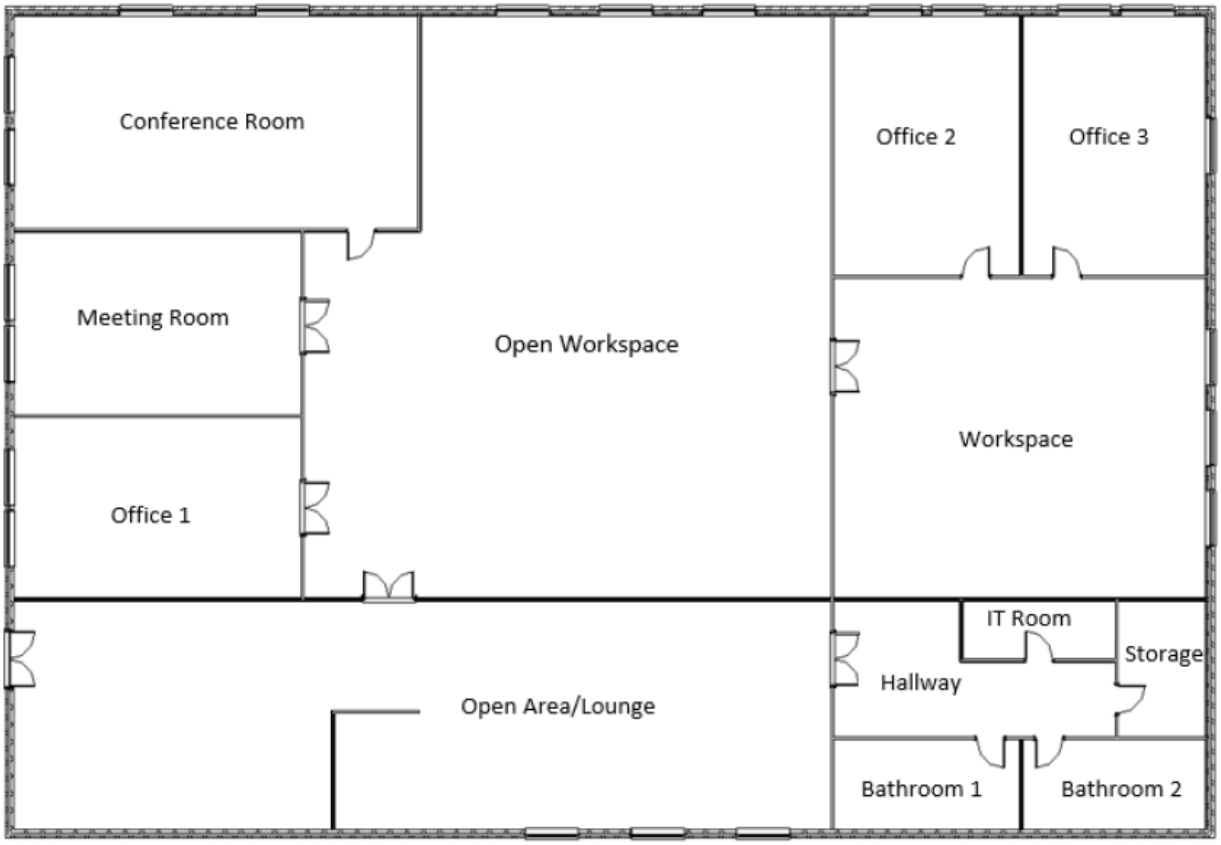


Figure 1: Floor plan of the office building

Net floor area of the rooms:

Office 1 = 54.15 m^2

Office 2 = 51.46 m^2

Office 3 = 49.8 m^2

Conference room = 89.78 m^2

Workspace = 136.13 m^2

Open workspace = 331.12 m^2

Open Area/ Lounge = 201.06 m^2

Meeting room = 61.66 m^2

Hallway = 29.83 m^2

IT Room = 8 m^2

Storage/ Closet = 11.34 m^2

Bathroom 1 = 16.17 m^2

Bathroom 2 = 16.77 m^2

Set point temperature for heating and cooling was assigned to each room.

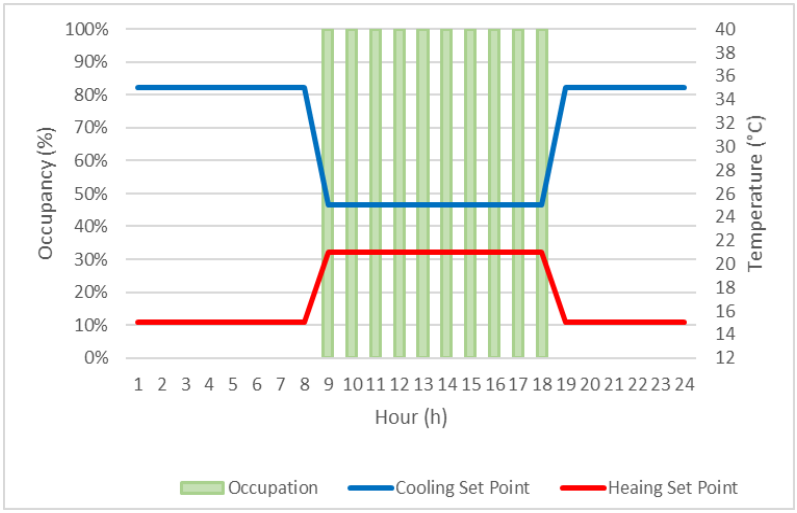
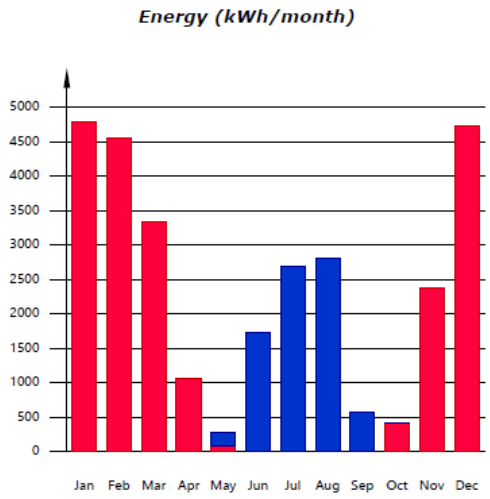
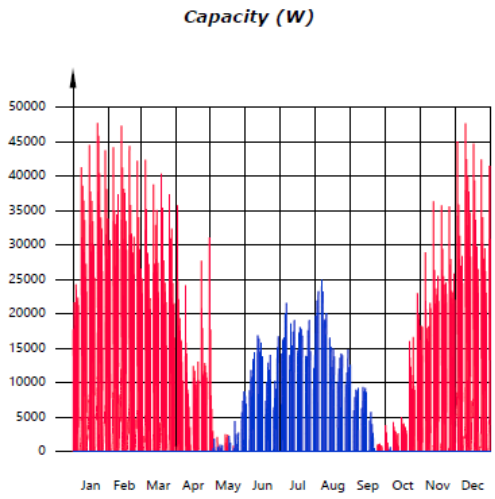


Figure 2: Occupancy profiles and set point temperature for heating and cooling

1. Monthly heating and cooling energy demand

Attending only to the energy demand to be covered by the heating and cooling systems, the energy and instantaneous net power requirements throughout the year are shown below:





2. Peak load for heating and cooling

Heating peak load of the building = 48.29 kW

Cooling peak load of the building = 25.59 kW

Space	Peak Load Heating	Peak Load Cooling
Open Area/Lounge	9.74	5.04
Meeting room	3.00	2.01
Office 1	2.71	1.82
Conference room	4.68	2.69
Open workspace	11.76	6.59
Hallway	1.53	0.55
IT room	0.59	0.16
Storage	0.85	0.21
Bathroom 1	1.25	0.31
Bathroom 2	1.19	0.33
Office 3	2.96	1.46
Office 2	2.65	1.20
Workspace	5.54	3.39