

Energy and Environmental Technologies for Building Systems:

Final Project

BUILDING:

Length= 10m

Width= 10m

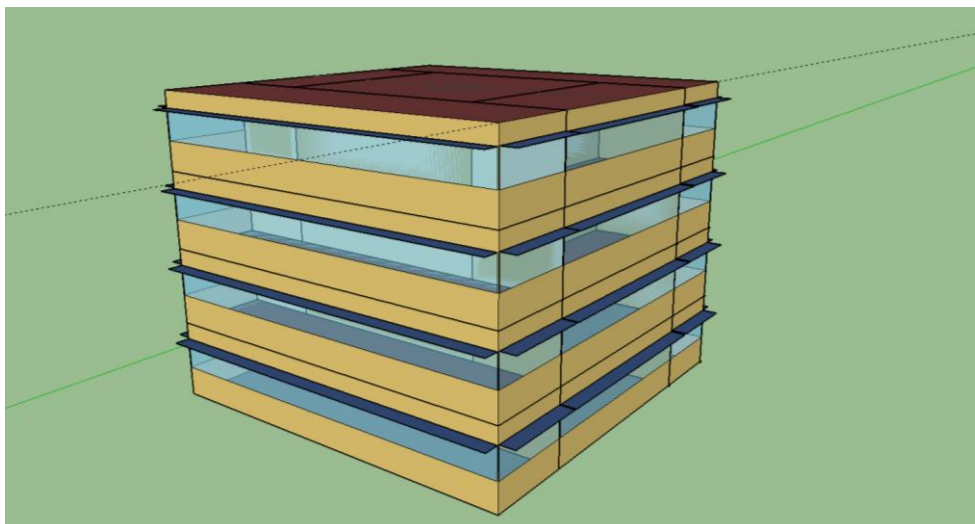
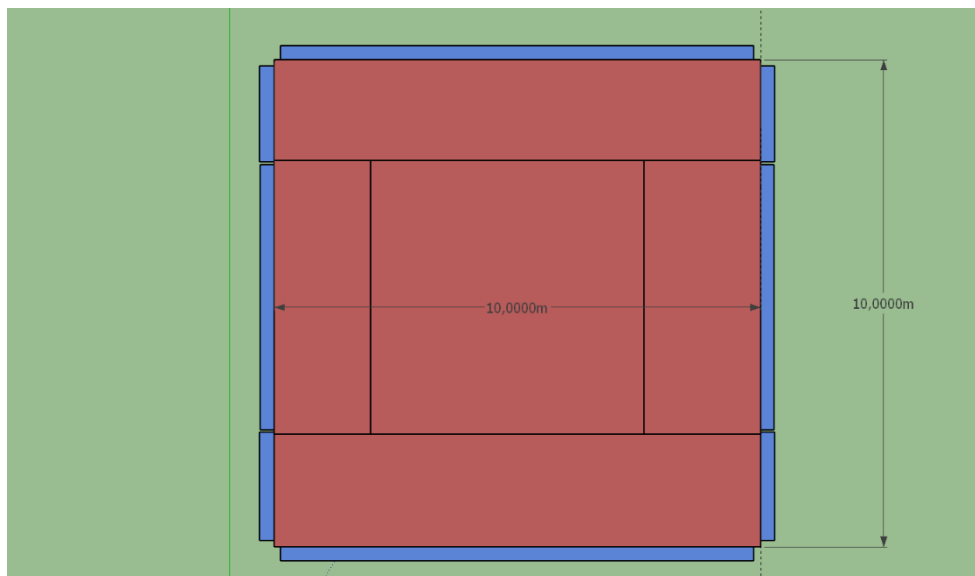
Floor height= 2m

Number of floor= 4

Glass= 0.4 of external surface

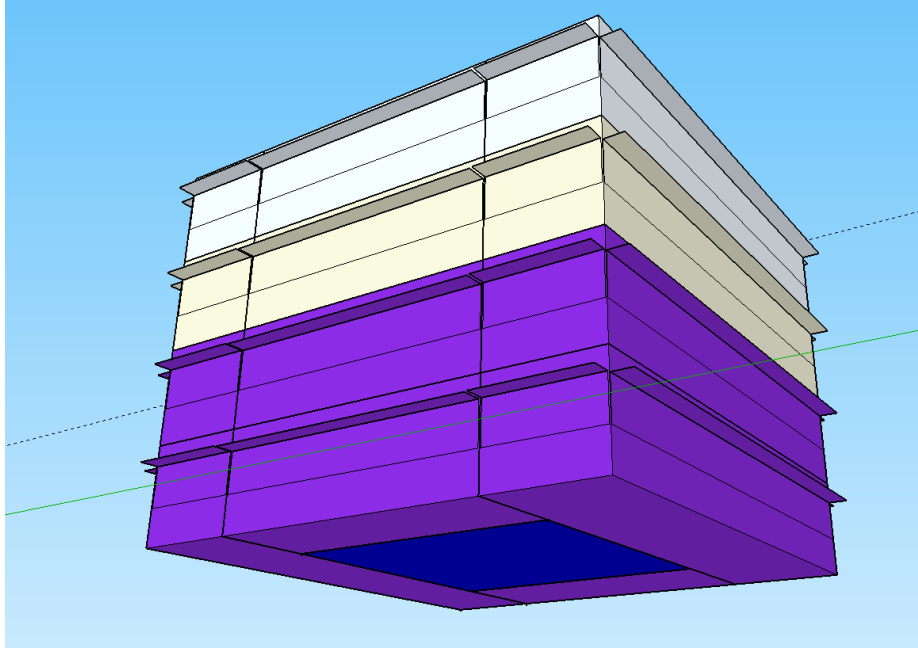
Spaces subdivision:

- GROUND AND 1ST FLOOR= Office, divided in Office Room + Breakroom
- 2ND FLOOR= Apartment
- 3RD FLOOR= Apartment



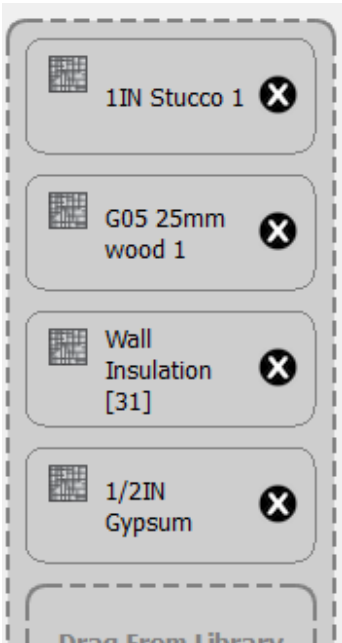
THERMAL ZONES

1. Office rooms
2. Breakroom (center of the floor)
3. Apartment
4. Apartment

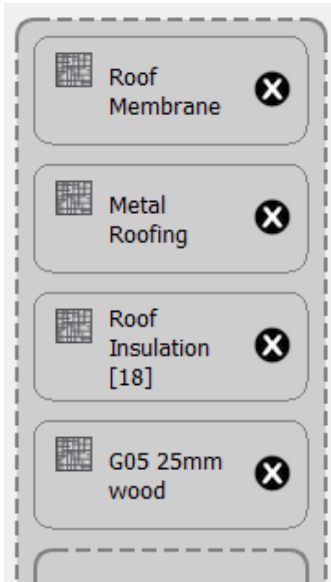


BASE CASE:

WALL



ROOF



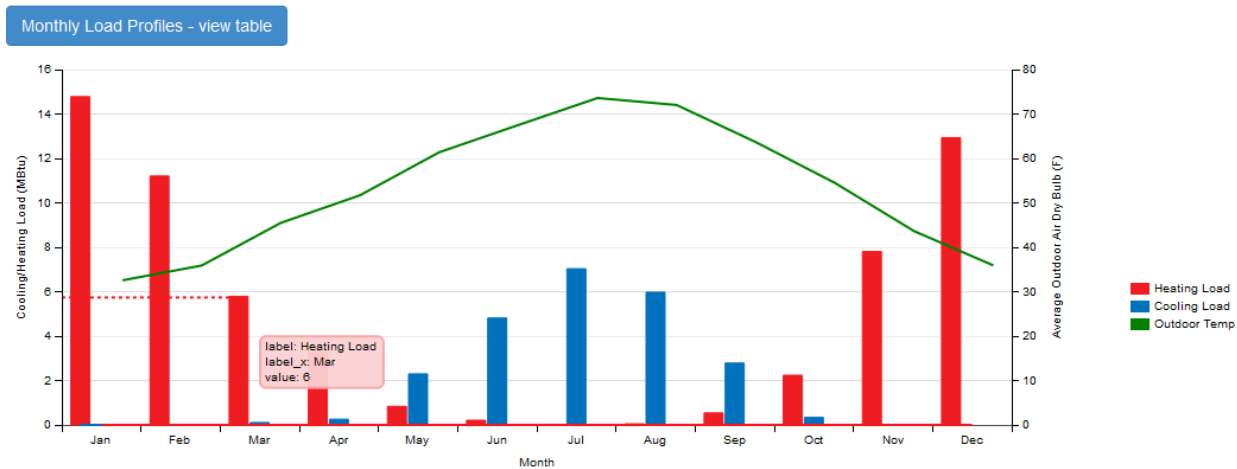
WINDOWS



Glass 167: 3 mm, 2.107300 W/mKconductivity

CONSUMPTION MILAN:

HVAC Load Profiles



CONSUMPTION MILANO:

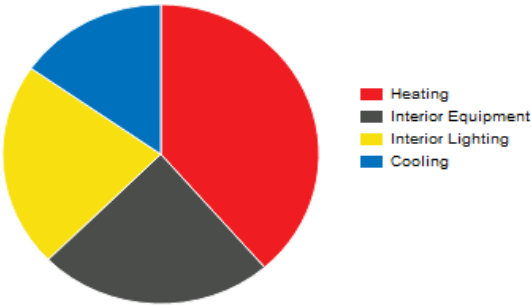
End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	62.99	0.00
Cooling	0.00	0.00	0.00	24.93	0.00	0.00
Interior Lighting	36.07	0.00	0.00	0.00	0.00	0.00
Exterior Lighting	0.00	0.00	0.00	0.00	0.00	0.00
Interior Equipment	39.09	0.00	0.00	0.00	0.00	0.00
Exterior Equipment	0.00	0.00	0.00	0.00	0.00	0.00
Fans	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	0.00	0.00	0.00	0.00	0.00	0.00
Heat Rejection	0.00	0.00	0.00	0.00	0.00	0.00
Humidification	0.00	0.00	0.00	0.00	0.00	0.00
Heat Recovery	0.00	0.00	0.00	0.00	0.00	0.00
Water Systems	0.00	0.00	0.00	0.00	0.00	0.00
Refrigeration	0.00	0.00	0.00	0.00	0.00	0.00
Generators	0.00	0.00	0.00	0.00	0.00	0.00
Total End Uses	75.17	0.00	0.00	24.93	62.99	0.00

Note: District heat appears to be the principal heating source based on energy usage.

Annual Overview

End Use - view table



Energy Use - view table

Heating: 38%

Cooling: 15%

InteriorLighting: 22%

InteriorEquipment: 25%

CONSUMPTION LONDON:

End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	119.68	0.00
Cooling	0.00	0.00	0.00	16.76	0.00	0.00
Interior Lighting	36.07	0.00	0.00	0.00	0.00	0.00
Exterior Lighting	0.00	0.00	0.00	0.00	0.00	0.00
Interior Equipment	39.09	0.00	0.00	0.00	0.00	0.00
Exterior Equipment	0.00	0.00	0.00	0.00	0.00	0.00
Fans	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	0.00	0.00	0.00	0.00	0.00	0.00
Heat Rejection	0.00	0.00	0.00	0.00	0.00	0.00
Humidification	0.00	0.00	0.00	0.00	0.00	0.00
Heat Recovery	0.00	0.00	0.00	0.00	0.00	0.00
Water Systems	0.00	0.00	0.00	0.00	0.00	0.00
Refrigeration	0.00	0.00	0.00	0.00	0.00	0.00
Generators	0.00	0.00	0.00	0.00	0.00	0.00
Total End Uses	75.17	0.00	0.00	16.76	119.68	0.00

Note: District heat appears to be the principal heating source based on energy usage.

Heating: +90% Cooling: -33%

CONSUMPTION PALERMO:

End Uses

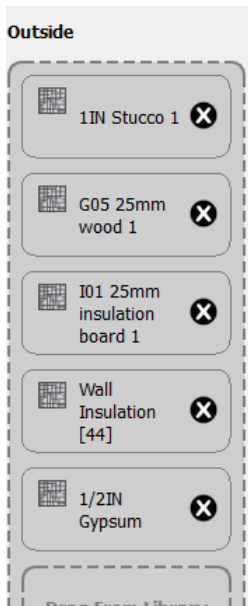
	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	9.16	0.00
Cooling	0.00	0.00	0.00	46.79	0.00	0.00
Interior Lighting	36.07	0.00	0.00	0.00	0.00	0.00
Exterior Lighting	0.00	0.00	0.00	0.00	0.00	0.00
Interior Equipment	39.09	0.00	0.00	0.00	0.00	0.00
Exterior Equipment	0.00	0.00	0.00	0.00	0.00	0.00
Fans	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	0.00	0.00	0.00	0.00	0.00	0.00
Heat Rejection	0.00	0.00	0.00	0.00	0.00	0.00
Humidification	0.00	0.00	0.00	0.00	0.00	0.00
Heat Recovery	0.00	0.00	0.00	0.00	0.00	0.00
Water Systems	0.00	0.00	0.00	0.00	0.00	0.00
Refrigeration	0.00	0.00	0.00	0.00	0.00	0.00
Generators	0.00	0.00	0.00	0.00	0.00	0.00
Total End Uses	75.17	0.00	0.00	46.79	9.16	0.00

Note: District heat appears to be the principal heating source based on energy usage.

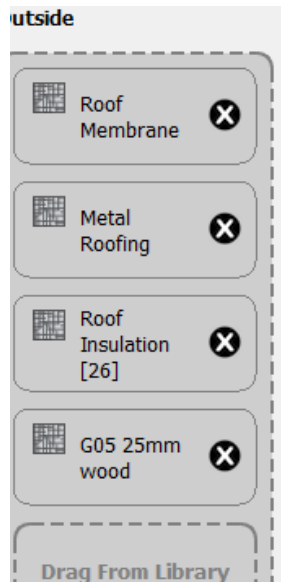
Heating: -85% Cooling: +87%

BEST CASE:

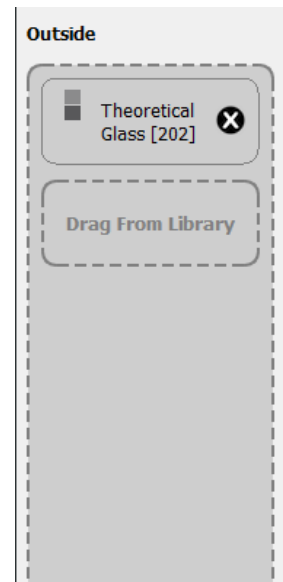
WALL



ROOF



WINDOWS



Glass 202: 3 mm, 0.019200 W/mkconductivity

CONSUMPTION MILAN (BEST CASE):

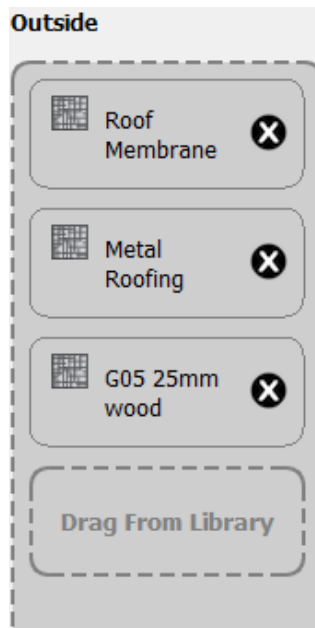
End Uses						
	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	40.75	0.00
Cooling	0.00	0.00	0.00	22.63	0.00	0.00
Interior Lighting	36.07	0.00	0.00	0.00	0.00	0.00
Exterior Lighting	0.00	0.00	0.00	0.00	0.00	0.00
Interior Equipment	39.09	0.00	0.00	0.00	0.00	0.00
Exterior Equipment	0.00	0.00	0.00	0.00	0.00	0.00
Fans	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	0.00	0.00	0.00	0.00	0.00	0.00
Heat Rejection	0.00	0.00	0.00	0.00	0.00	0.00
Humidification	0.00	0.00	0.00	0.00	0.00	0.00
Heat Recovery	0.00	0.00	0.00	0.00	0.00	0.00
Water Systems	0.00	0.00	0.00	0.00	0.00	0.00
Refrigeration	0.00	0.00	0.00	0.00	0.00	0.00
Generators	0.00	0.00	0.00	0.00	0.00	0.00
Total End Uses	75.17	0.00	0.00	22.63	40.75	0.00

Note: District heat appears to be the principal heating source based on energy usage.

The loads in the worst case are different:
heating: -35% cooling: -8%

WORST CASE:

WALL



ROOF



WINDOWS



Clear: 3 mm, 0.900000 W/mkconductivity

CONSUMPTION MILAN (WORST CASE):

End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	86.47	0.00
Cooling	0.00	0.00	0.00	59.69	0.00	0.00
Interior Lighting	36.07	0.00	0.00	0.00	0.00	0.00
Exterior Lighting	0.00	0.00	0.00	0.00	0.00	0.00
Interior Equipment	39.09	0.00	0.00	0.00	0.00	0.00
Exterior Equipment	0.00	0.00	0.00	0.00	0.00	0.00
Fans	0.00	0.00	0.00	0.00	0.00	0.00
Pumps	0.00	0.00	0.00	0.00	0.00	0.00
Heat Rejection	0.00	0.00	0.00	0.00	0.00	0.00
Humidification	0.00	0.00	0.00	0.00	0.00	0.00
Heat Recovery	0.00	0.00	0.00	0.00	0.00	0.00
Water Systems	0.00	0.00	0.00	0.00	0.00	0.00
Refrigeration	0.00	0.00	0.00	0.00	0.00	0.00
Generators	0.00	0.00	0.00	0.00	0.00	0.00
Total End Uses	75.17	0.00	0.00	59.69	86.47	0.00

Note: District heat appears to be the principal heating source based on energy usage.

The loads in the worst case are different:

heating: +37% cooling: +124%