



POLITECNICO
MILANO 1863

ENERGY AND ENVIRONMENTAL TECHNOLOGIES FOR BUILDING SYSTEMS – OPENSTUDIO PROJECT

BY

MELTEM BARLAY

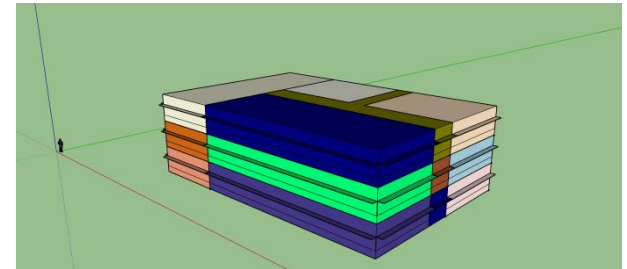
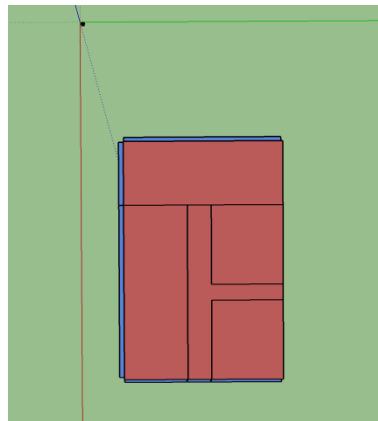
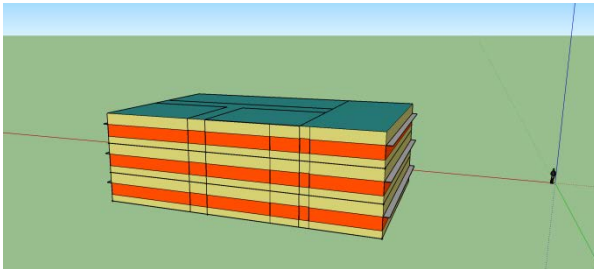
BUKET ÖZCAN

GIANLUCA LORUSSO

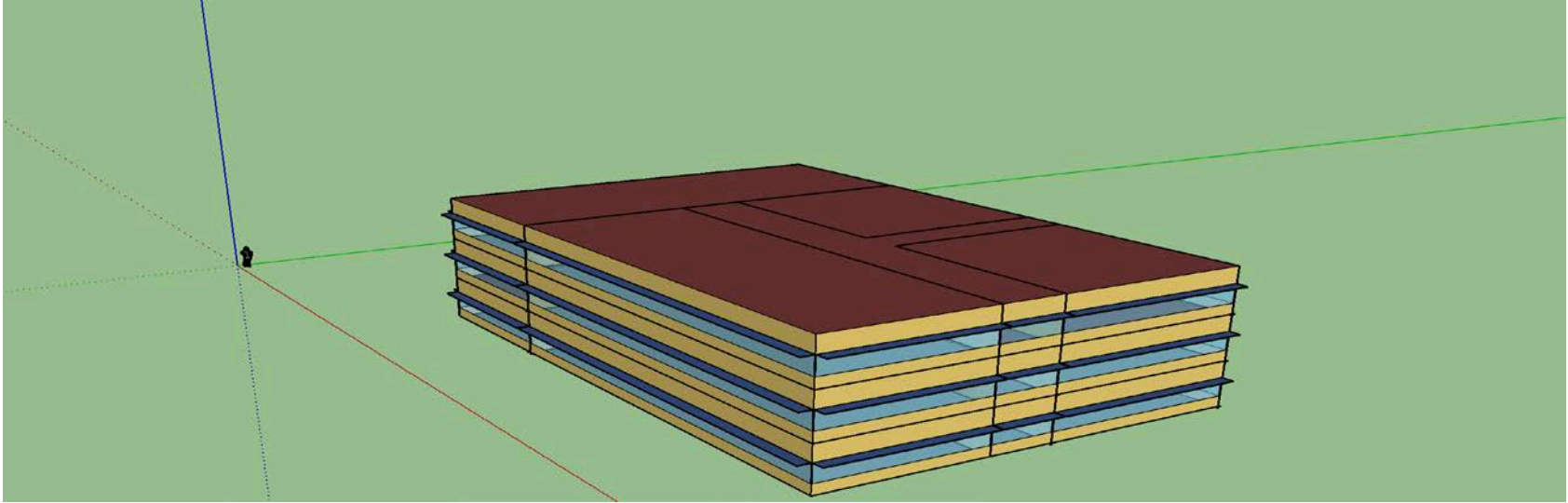
INTRODUCTION

In this project:

- The office building was designed with 3 storey building in Sketc Up and rendered by using Open Studio.
- In the model, a base case condition was simulated for parametric study in three different location which are Rome(IT), İzmir(TR) and Moscow(RU).
- As the base case İzmir was selected. For this location, 3 different wall properties -which are default, better and worse cases- was modelled. 2 different windows were modelled for a base case.

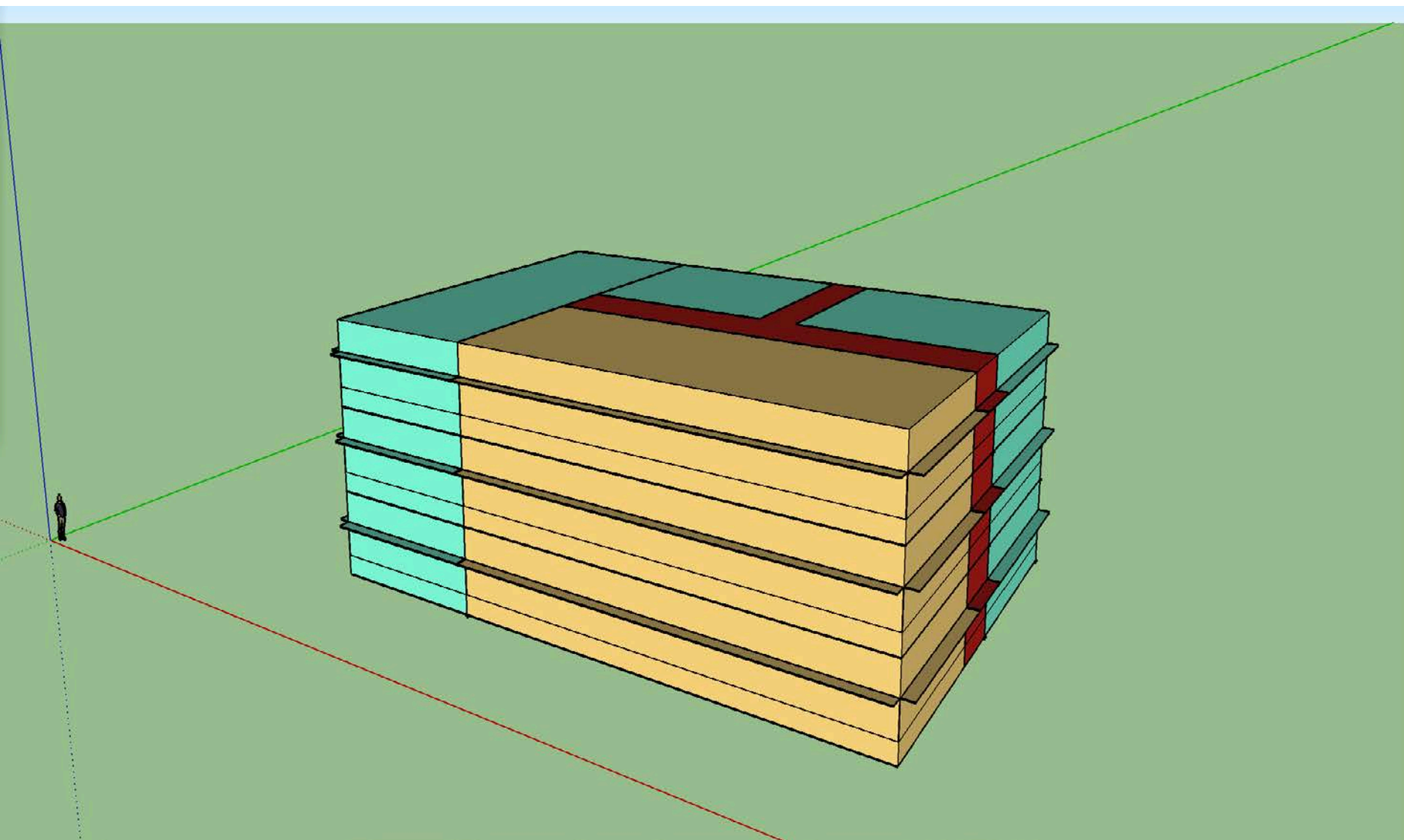


THE BUILDING CHARACTERISTICS



The office building was considered:

- 3 stories, each story has same area and divided 5 thermal zones.
- The total floor area 1800 m².
- Windows are in all directions.
- 40% of fenestration rate on the walls.
- Shading in all directions, except the north direction.



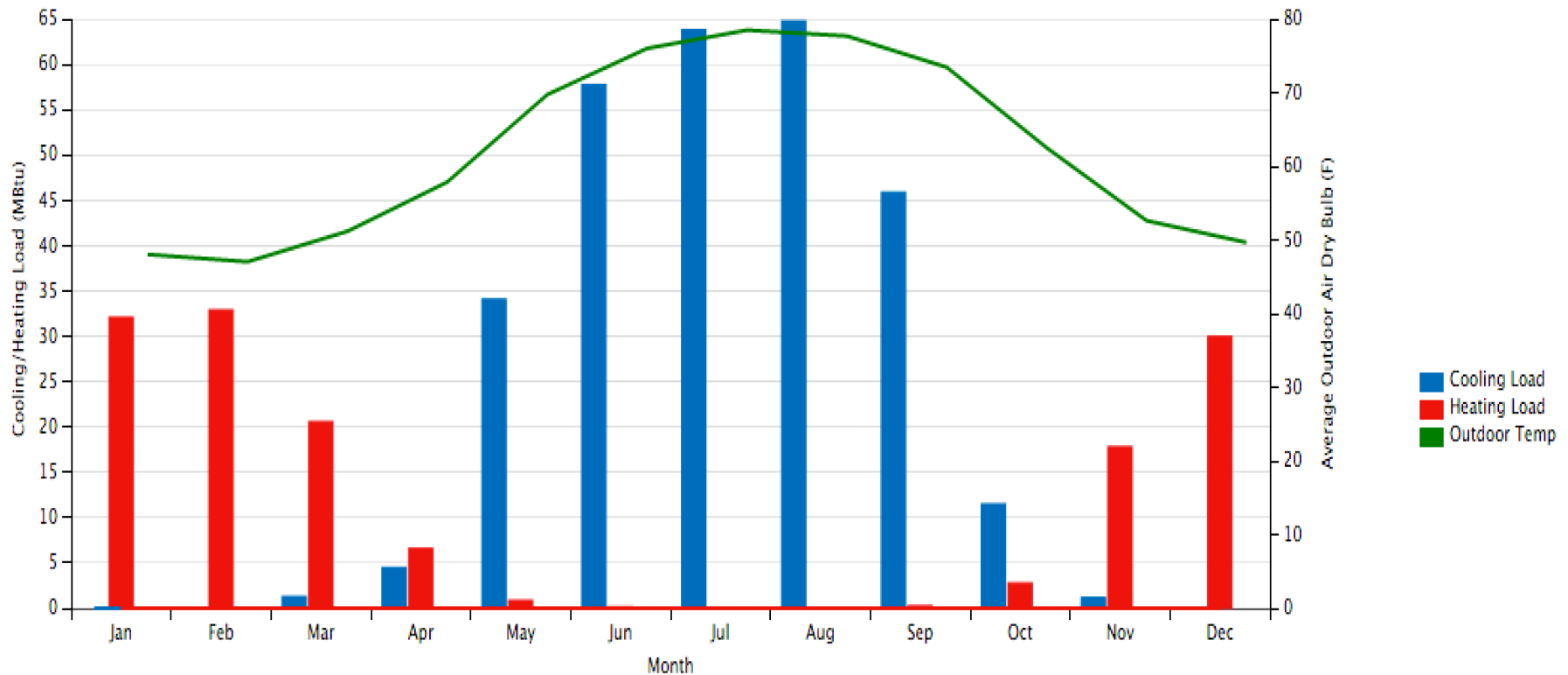
THE LOCATION CONDITIONS

	Value
Weather File	IZMIR - TUR IWECDATA WMO#=172180
Latitude	38.50
Longitude	27.02
Elevation	16 (ft)
Time Zone	2.00
North Axis Angle	0.00

	Value
Weather File	Roma-Fiumicino - ITA IGDG WMO#=162420
Latitude	41.80
Longitude	12.23
Elevation	10 (ft)
Time Zone	1.00
North Axis Angle	0.00

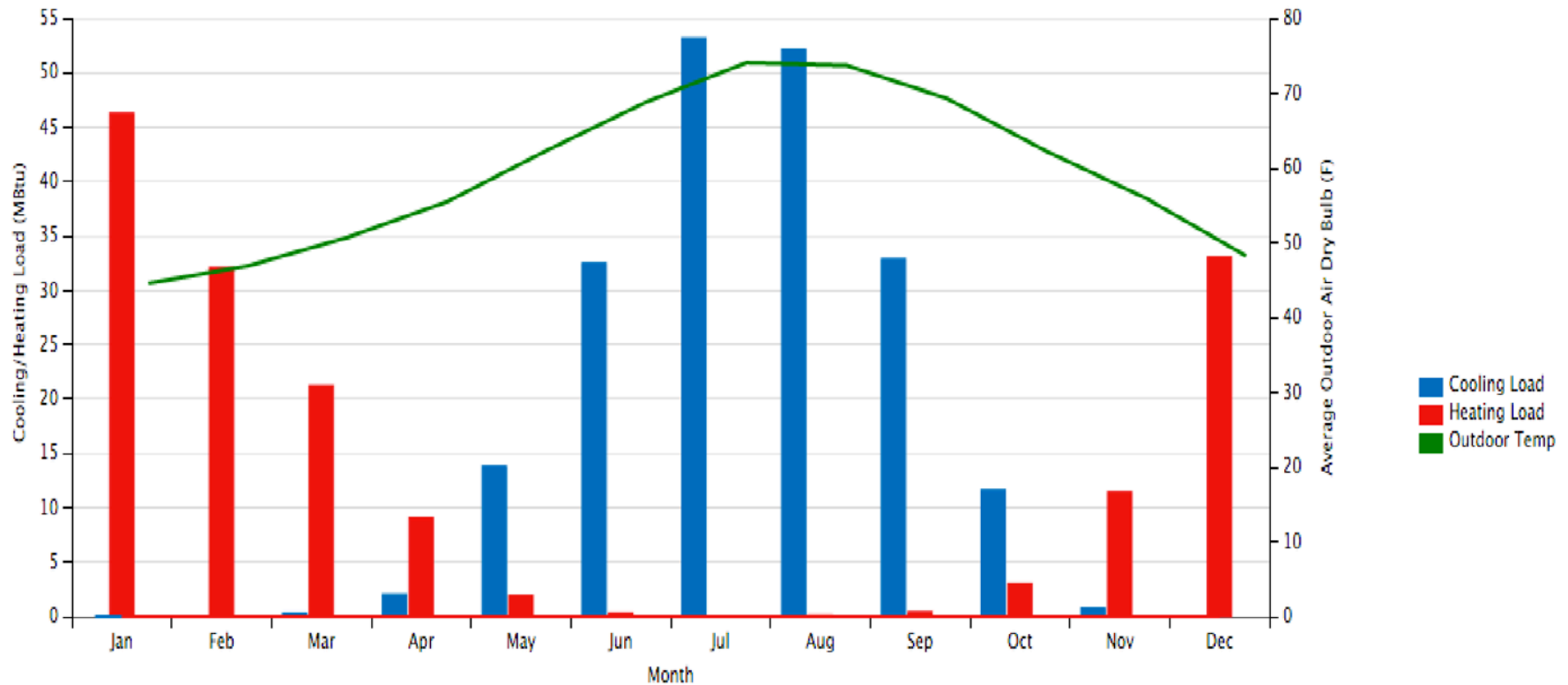
	Value
Weather File	MOSCOW - RUS IWECDATA WMO#=276120
Latitude	55.75
Longitude	37.63
Elevation	512 (ft)
Time Zone	3.00
North Axis Angle	0.00

HVAC LOAD PROFILE: İZMİR



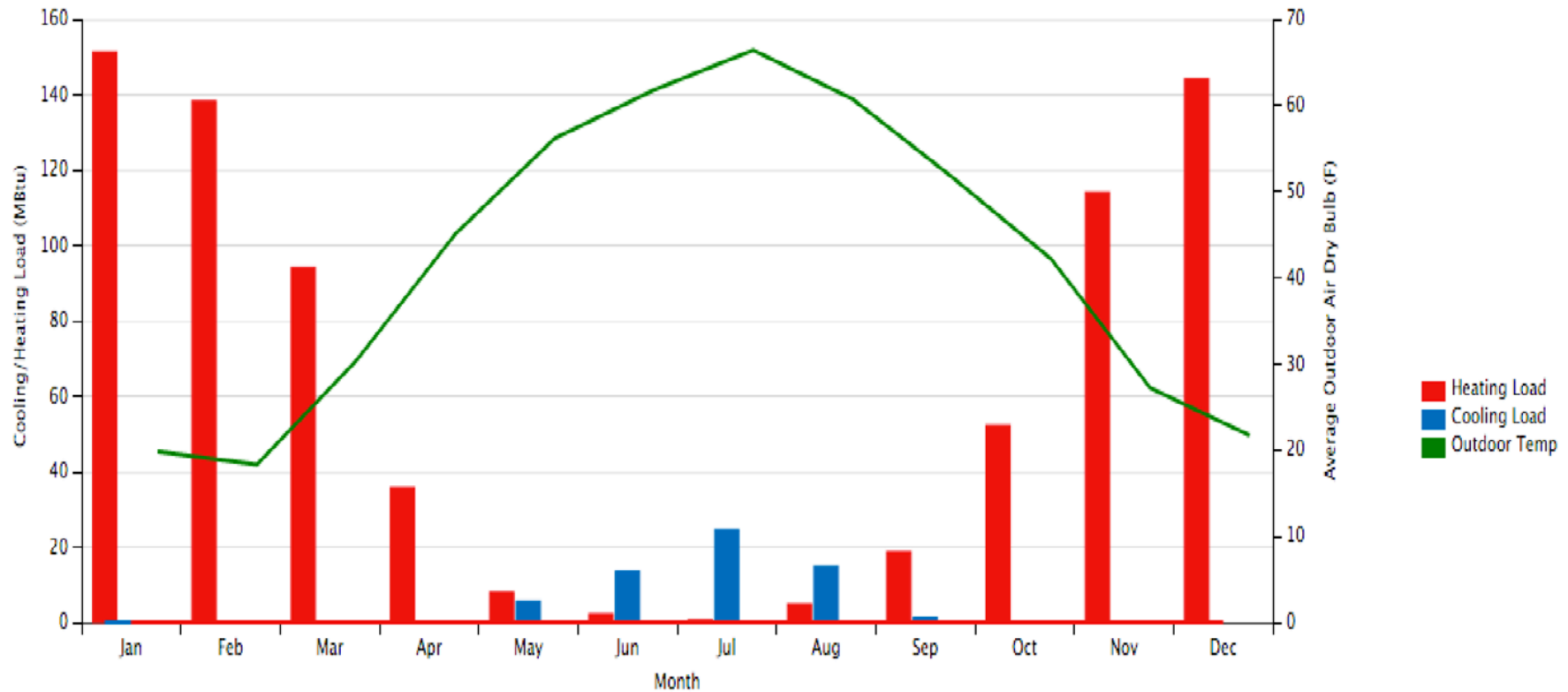
- In the İzmir graph, the cooling load reaches the 65 MBtu whereas the hottest month is August for İzmir climate. The heating load has only three peak, 30-32 MBtu, during winter.

HVAC LOAD PROFILE: ROME



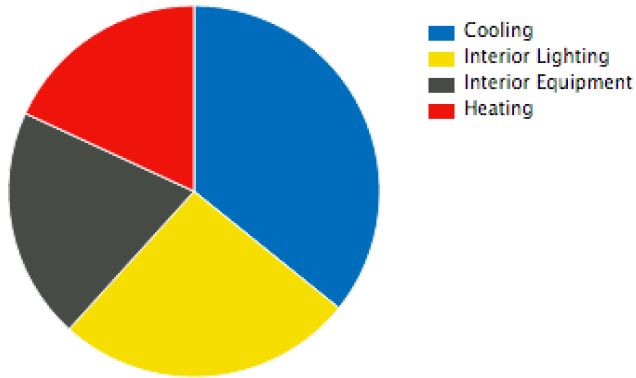
- For this city, the highest cooling load is in July with 53 MBtu. For the heating load, the highest peak reaches 46 MBtu whereas in January.

HVAC LOAD PROFILE: MOSCOW

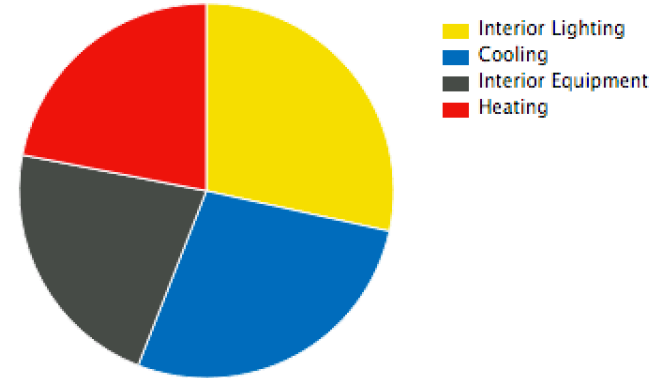


- As is seen, the heating load is needed up to 150 MBtu during winter season. The cooling load reaches only up to 23 MBtu.

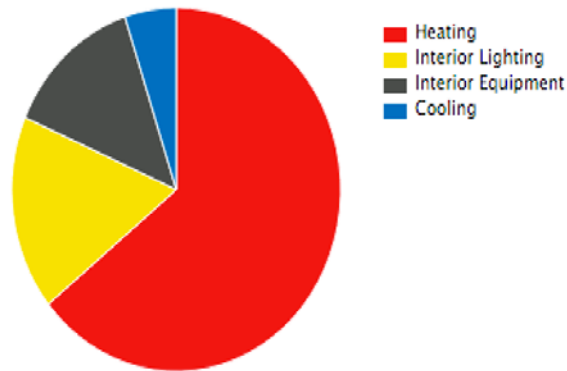
END USE COMPARISON



İzmir

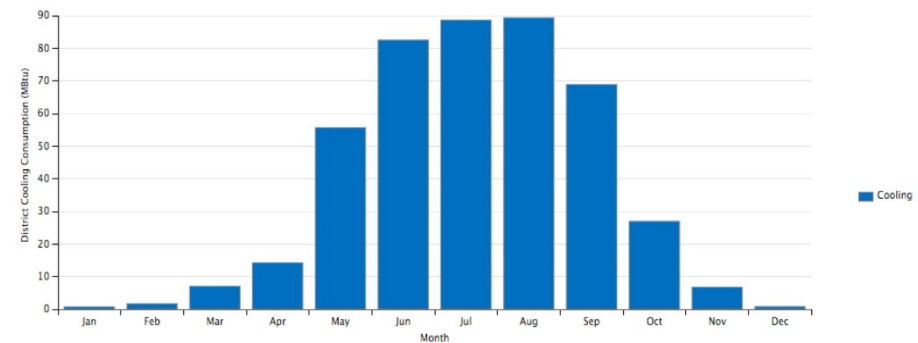
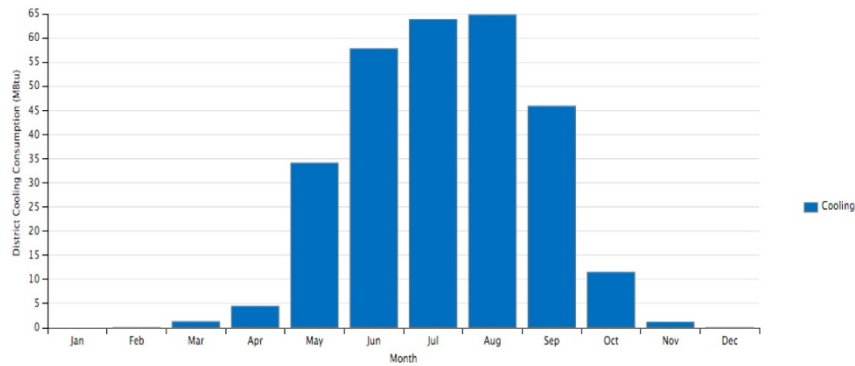
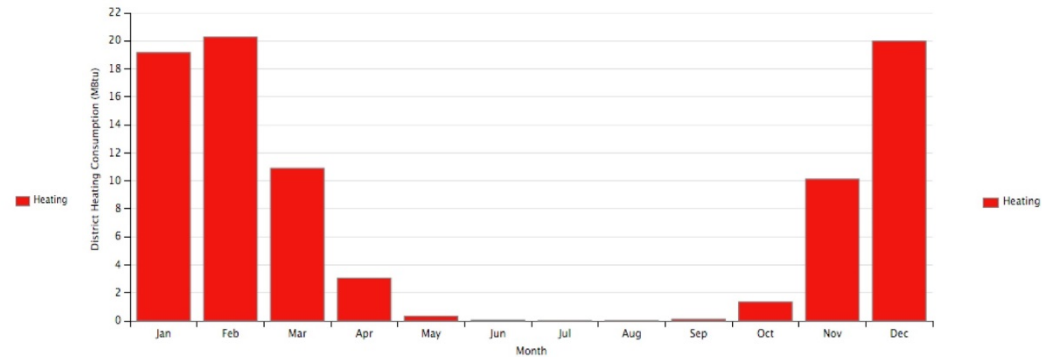
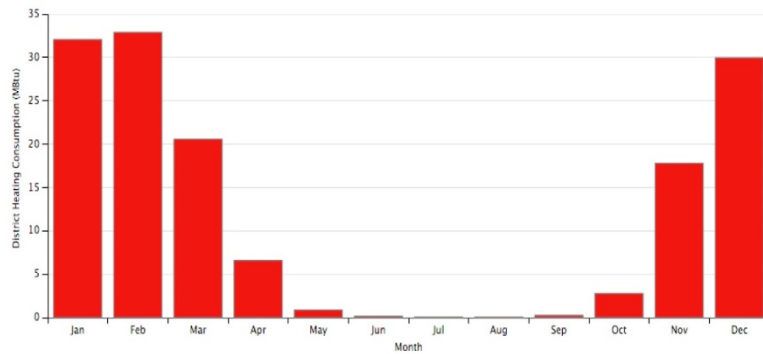
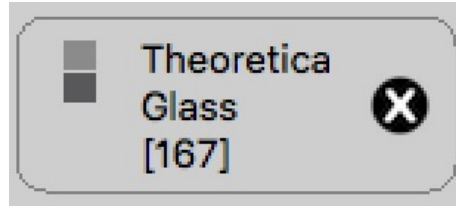


Rome



Moscow

THE WINDOWS (FOR **İZMİR** BASE CASE)



THE WINDOWS (FOR **İZMİR** BASE CASE)

Construction	Net Area (ft^2)	U-factor (Btu/ft^2*h*R)	SHGC
Clear window	3,937	1.04	0.86

Construction	Net Area (ft^2)	U-factor (Btu/ft^2*h*R)	SHGC
ASHRAE 189.1-2009 ExtWindow ClimateZone 1	3,937	1.13	0.25

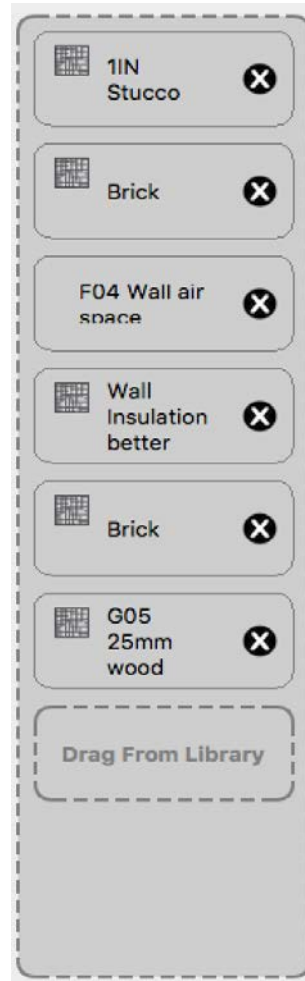
	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	944.53	524.74	524.74
Net Site Energy	944.53	524.74	524.74
Total Source Energy	2044.18	1135.66	1135.66
Net Source Energy	2044.18	1135.66	1135.66

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	839.13	466.19	466.19
Net Site Energy	839.13	466.19	466.19
Total Source Energy	2091.11	1161.73	1161.73
Net Source Energy	2091.11	1161.73	1161.73

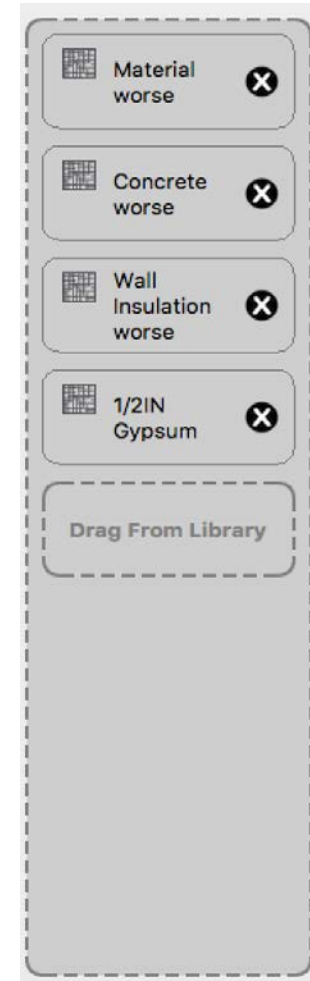
THE WALLS



Base Case



Better Case

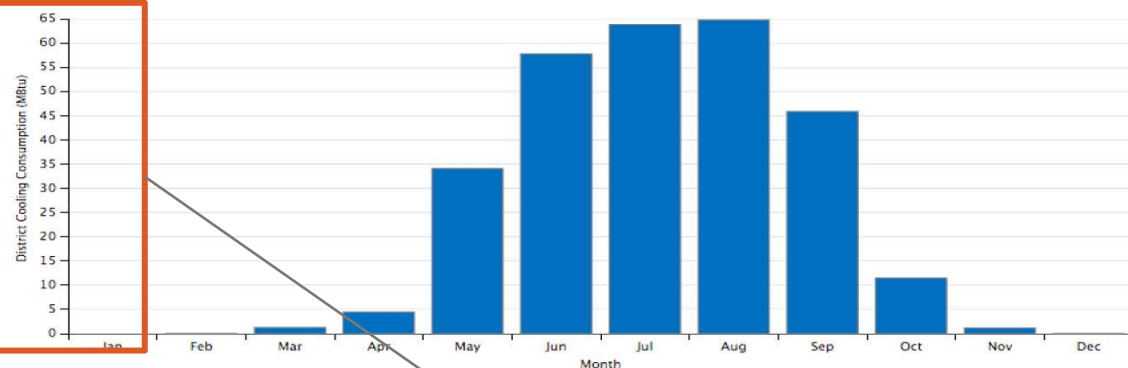


Worse Case

COMPARISON FOR 3 CASES (DISTRICT COOLING)

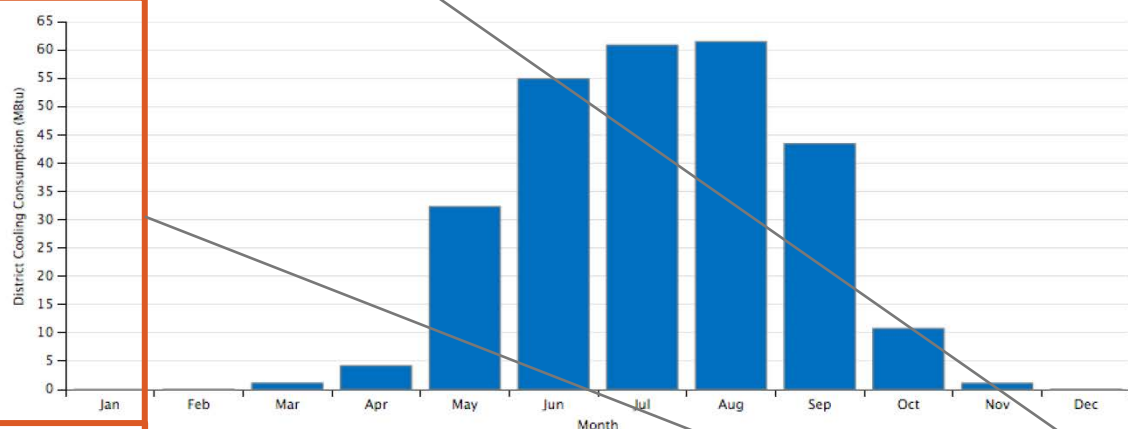
- Base Case

284.72 MBTu – total cooling consumption



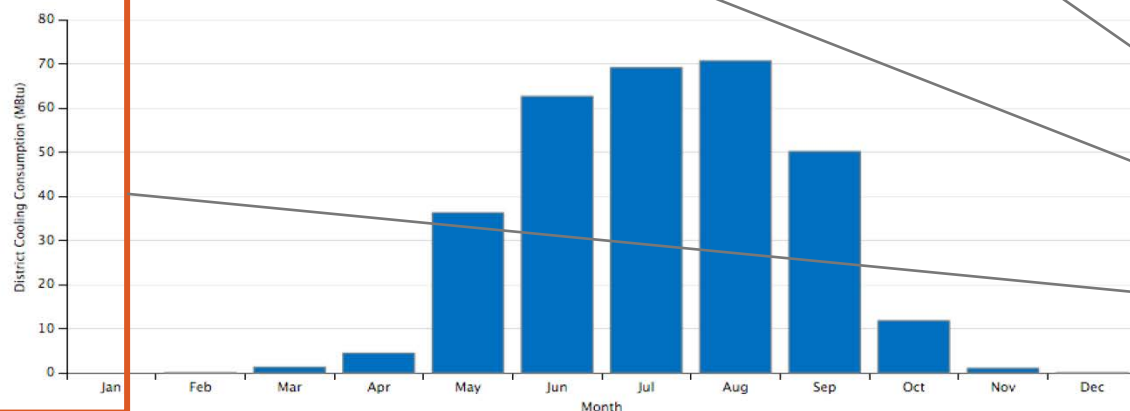
- Better Case

279.15 MBTu – total cooling consumption



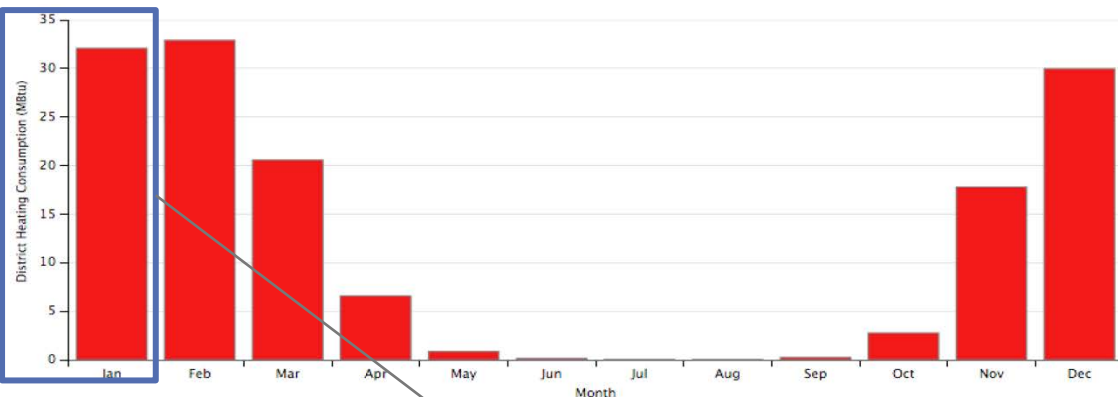
- Worse Case

307.33 MBTu – total cooling consumption



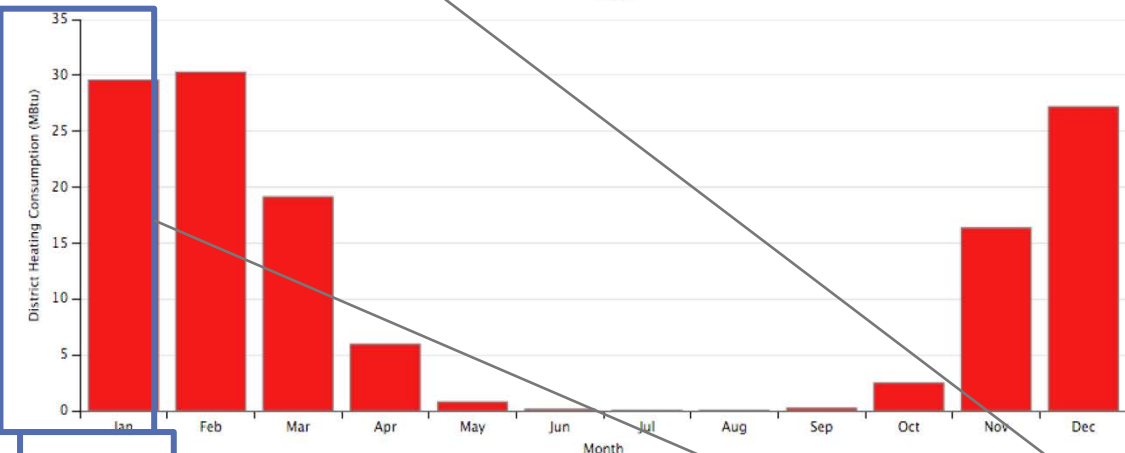
The scales are different

COMPARISON FOR 3 CASES (DISTRICT HEATING)



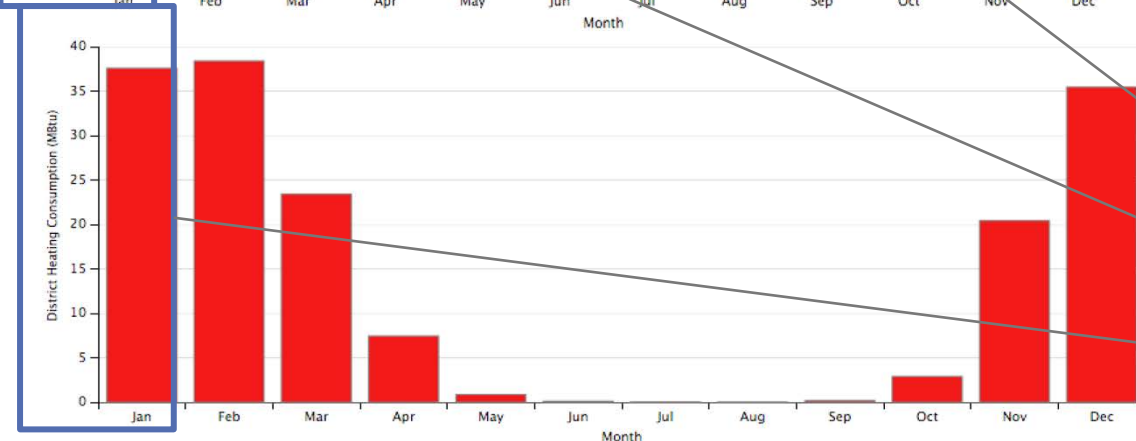
- Base Case

143.99 MBTu – total heating consumption



- Better Case

132.23 MBTu GJ – total heating consumption



- Worse Case

166.6 GJ – total heating consumption

The scales are different

CONCLUSIONS

In comparison between the location, Moscow does not need any supply cooling energy during the year despite İzmir and Rome need supply cooling energy. However, the heating supply energy is needed where in three location, Moscow has the highest.

Energy consumption is apparently reduced when some improvements are applied to the building walls.

The better case does not considerably changed, while the worse case has high value of changing.

Hence, the modifications are suggested in order to energy saving , yet the cost must be take into account.