OPEN STUDIO PROJECT

TECHNICAL ENVIRONMENTAL SYSTEM

POLITECNICO
MILANO 1863

Group

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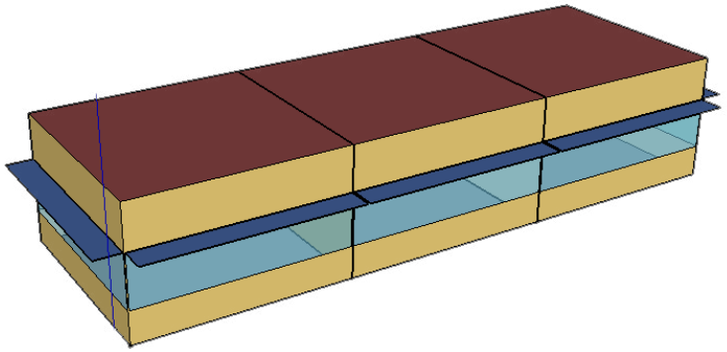
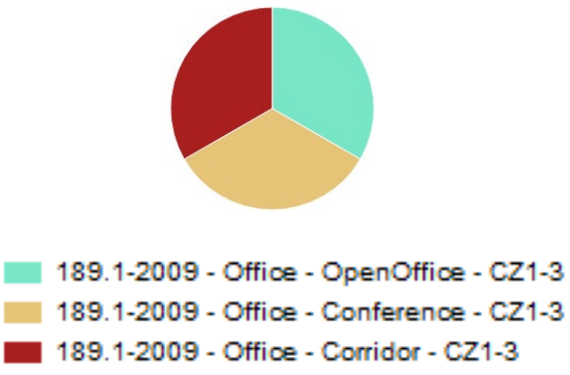
Project information

Building



Geometry:

Building type: office
Number of floors: 1
Total Building Area : 75 m2 (15*5)



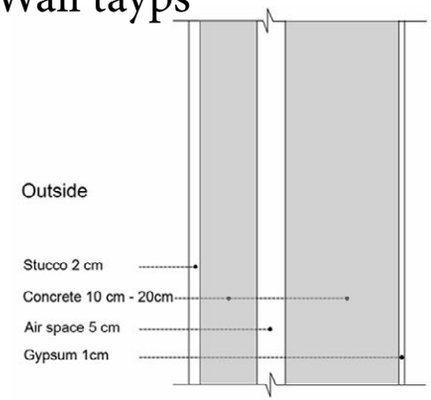
Cities

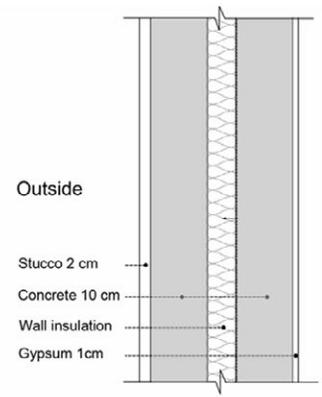
PIACENZA, ITALY
Warm and temperate

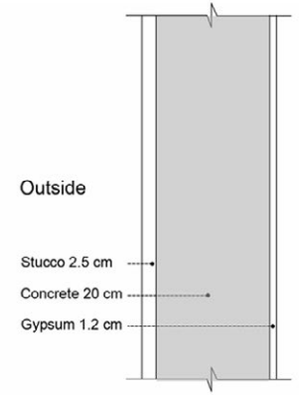
ISFAHAN, IRAN
Hot and dray

OSLO, NORWAY
Very cold

Wall tayps

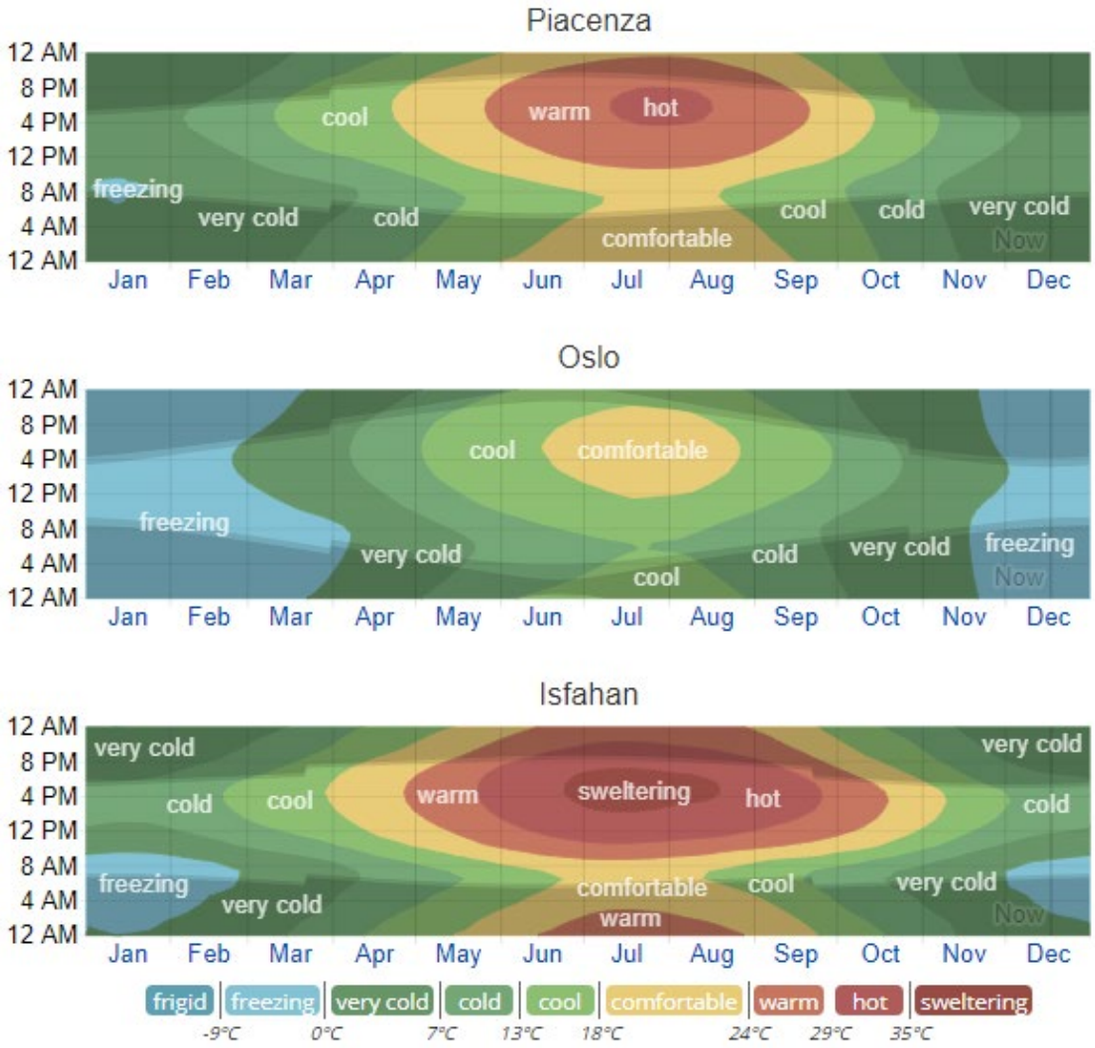


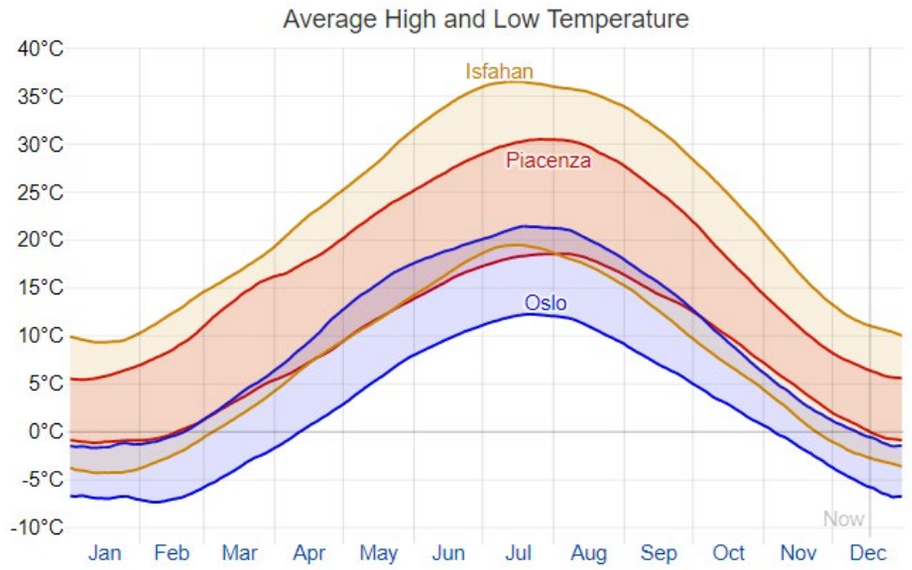


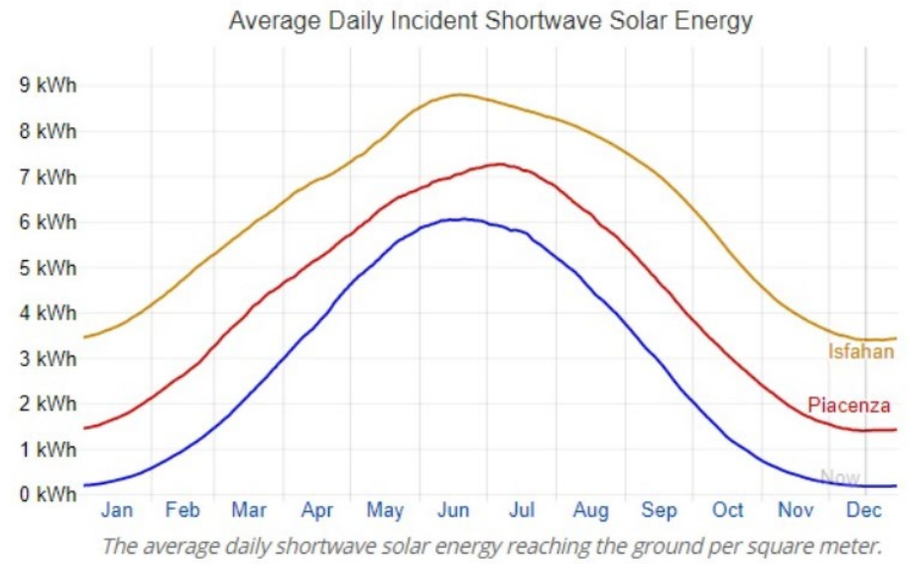


Base wall

WEATHER DATA



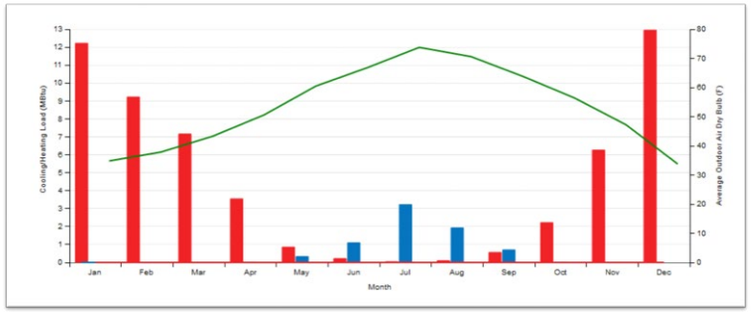




The average daily shortwave solar energy reaching the ground per square meter.

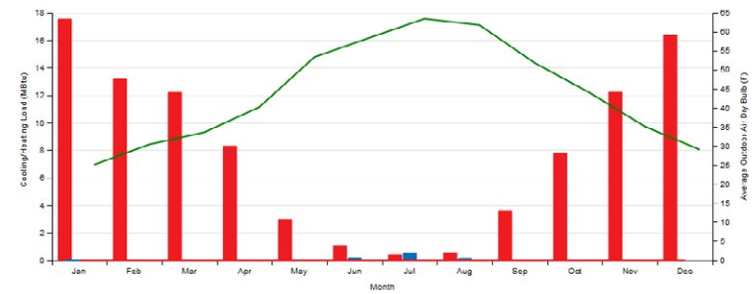
BASE CASE WALL ANALYSIS

Piacenza, Italy



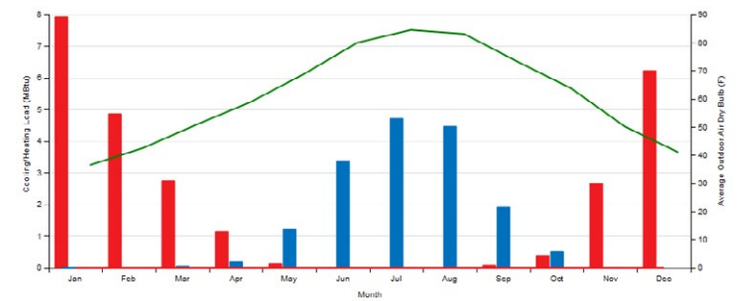
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Outdoor Air Dry Bulb (F)	34.8 F 1.5 C	37.9 F 3.3 C	43.3 F 6.2 C	50.6 F 10.3 C	60.5 F 15.8 C	66.8 F 19.3 C	73.8 F 23.2 C	70.6 F 21.4 C	63.8 F 17.6 C	56.4 F 13.5 C	47.2 F 8.4 C	33.7 F 0.9 C
Cooling Load (MBtu)	0.0	0.0	0.0	0.03	0.33	1.1	3.22	1.93	0.7	0.02	0.0	0.0
Heating Load (MBtu)	12.22	9.22	7.16	3.55	0.85	0.21	0.04	0.1	0.56	2.22	6.26	12.95

Oslo, Norway



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Outdoor Air Dry Bulb (F)	25.2 F -3.7 C	30.5 F -0.8 C	33.6 C 0.8 C	40.3 F 4.6 C	53.4 F 11.8 C	58.5 F 14.7 C	63.4 F 17.4 C	61.8 F 16.5 C	51.9 F 11.0 C	44.1 F 6.7 C	35.2 F 1.7 C	29.1 F -1.6 C
Cooling Load (MBtu)	0.0	0.0	0.0	0.01	0.04	0.21	0.53	0.18	0.0	0.0	0.0	0.0
Heating Load (MBtu)	17.54	13.24	12.23	8.32	2.99	1.09	0.41	0.58	3.59	7.78	12.24	16.39

Isfahan, Iran



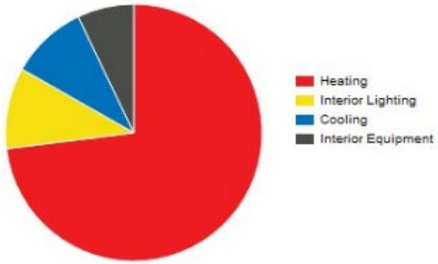
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Outdoor Air Dry Bulb (F)	36.5 F 2.5 C	42.6 F 5.8 C	50.9 F 10.5 C	58.9 F 14.9 C	68.9 F 20.5 C	80.0 F 26.6 C	84.5 F 29.1 C	83.1 F 28.3 C	73.2 F 22.8 C	63.7 F 17.6 C	50.2 F 10.1 C	41.1 F 5.0 C
Cooling Load (MBtu)	0.0	0.0	0.05	0.2	1.21	3.38	4.72	4.47	1.92	0.51	0.01	0.0
Heating Load (MBtu)	7.93	4.87	2.76	1.15	0.15	0.0	0.0	0.0	0.08	0.4	2.66	6.23

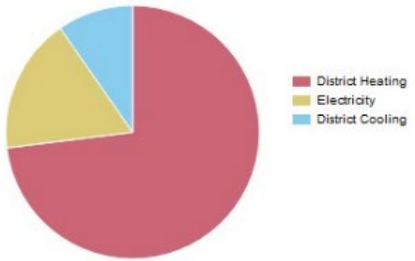
BASE CASE WALL ANALYSIS

End Use

Energy Use

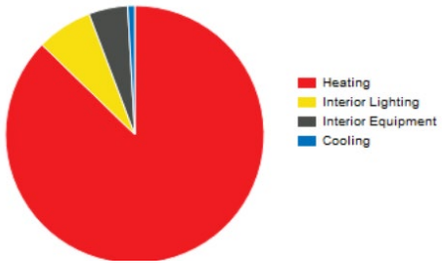
Piacenza, Italy annual overview

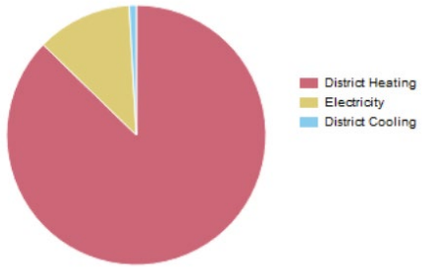




End Use	Consumption (kBtu)
Heating	55,343
Cooling	7,327
Interior Lighting	7,725
Exterior Lighting	0
Interior Equipment	5,393

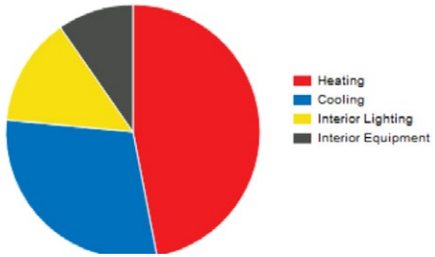
Oslo, Norway annual overview

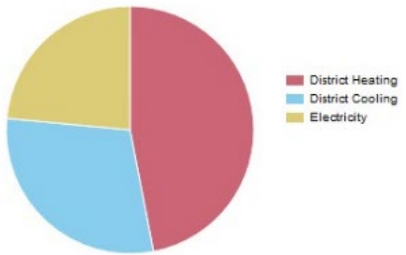




End Use	Consumption (kBtu)
Heating	96,393
Cooling	967
Interior Lighting	7,725
Exterior Lighting	0
Interior Equipment	5,393

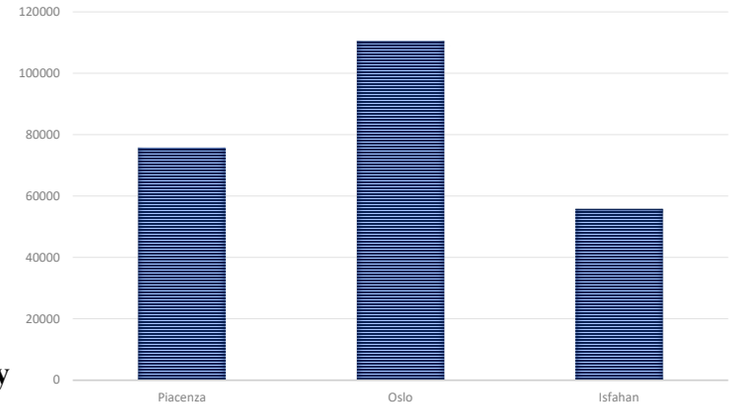
Isfahan,Iran annual overview





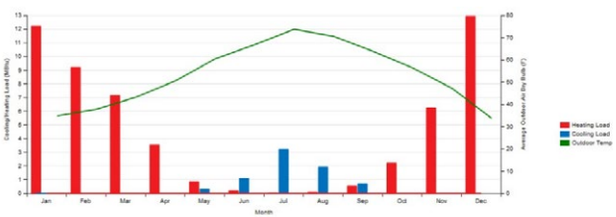
End Use	Consumption (kBtu)
Heating	26,207
Cooling	16,483
Interior Lighting	7,725
Exterior Lighting	0
Interior Equipment	5,393

Net Site Energy



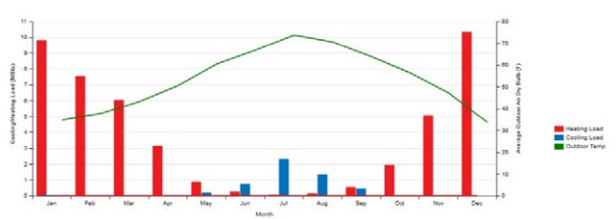
BASE CASE WALL ANALYSIS

Wall 1



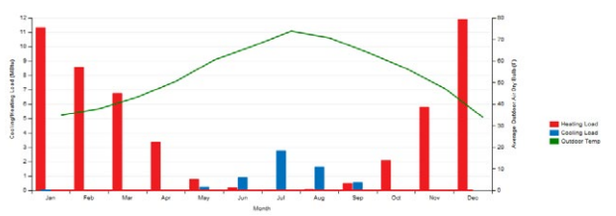
PIACENZA 1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Outdoor Air Dry Bulb (F) Average Outdoor Air Dry Bulb (C)	34.8 F 1.5 C	37.9 F 3.3 C	43.3 F 6.2 C	50.6 F 10.3 C	60.5 F 15.8 C	66.8 F 19.3 C	73.8 F 23.2 C	70.6 F 21.4 C	63.8 F 17.6 C	56.4 F 13.5 C	47.2 F 8.4 C	33.7 F 0.9 C
Cooling Load (MBtu)	0.0	0.0	0.0	0.03	0.33	1.1	3.22	1.93	0.7	0.02	0.0	0.0
Heating Load (MBtu)	12.22	9.22	7.16	3.55	0.85	0.21	0.04	0.1	0.56	2.22	6.26	12.95

Wall 2



PIACENZA 2	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Outdoor Air Dry Bulb (F) Average Outdoor Air Dry Bulb (C)	34.8 F 1.5 C	37.9 F 3.3 C	43.3 F 6.2 C	50.6 F 10.3 C	60.5 F 15.8 C	66.8 F 19.3 C	73.8 F 23.2 C	70.6 F 21.4 C	63.8 F 17.6 C	56.4 F 13.5 C	47.2 F 8.4 C	33.7 F 0.9 C
Cooling Load (MBtu)	0.0	0.0	0.0	0.01	0.19	0.76	2.32	1.35	0.45	0.0	0.0	0.0
Heating Load (MBtu)	9.81	7.54	6.04	3.14	0.88	0.25	0.05	0.12	0.55	1.95	5.06	10.33

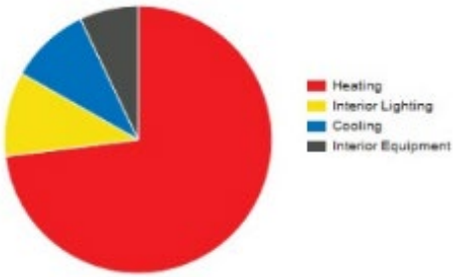
Wall 3

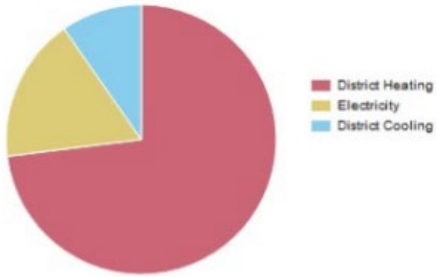


PIACENZA 3	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Outdoor Air Dry Bulb (F) Average Outdoor Air Dry Bulb (C)	34.8 F 1.5 C	37.9 F 3.3 C	43.3 F 6.2 C	50.6 F 10.3 C	60.5 F 15.8 C	66.8 F 19.3 C	73.8 F 23.2 C	70.6 F 21.4 C	63.8 F 17.6 C	56.4 F 13.5 C	47.2 F 8.4 C	33.7 F 0.9 C
Cooling Load (MBtu)	0.0	0.0	0.0	0.01	0.23	0.91	2.76	1.63	0.53	0.0	0.0	0.0
Heating Load (MBtu)	11.31	8.57	6.74	3.34	0.78	0.19	0.03	0.08	0.48	2.07	5.8	11.9

BASE CASE WALL ANALYSIS

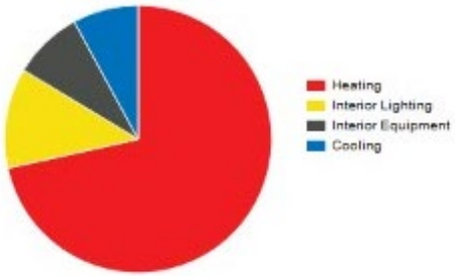
Wall 1

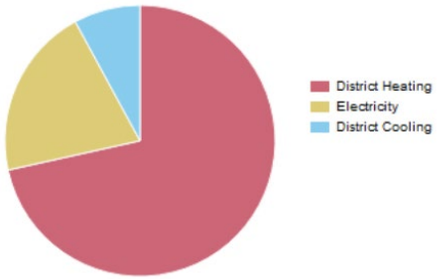




End Use	Consumption (kBtu)
Heating	55,343
Cooling	7,327
Interior Lighting	7,725
Exterior Lighting	0
Interior Equipment	5,393

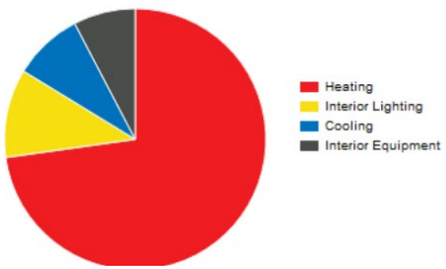
Wall 2

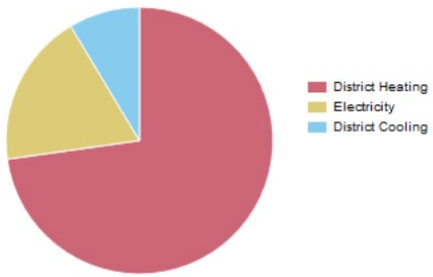




End Use	Consumption (kBtu)
Heating	45,723
Cooling	5,080
Interior Lighting	7,725
Exterior Lighting	0
Interior Equipment	5,393

Wall 3





End Use	Consumption (kBtu)
Heating	51,277
Cooling	6,066
Interior Lighting	7,725
Exterior Lighting	0
Interior Equipment	5,393

U- VALUES

Wall 1

Construction	Net Area (ft^2)	Surface Count	R Value (ft^2*h*R/Btu)
ASHRAE 189.1-2009 ExtRoof IEAD ClimateZone 1	807	3	19.96
model ext wall	787	8	1.33

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

U=0.75 Btu/ft^2*h*R U=4.25 w/m^2.k

Wall 2

Construction	Net Area (ft^2)	Surface Count	R Value (ft^2*h*R/Btu)
ASHRAE 189.1-2009 ExtRoof IEAD ClimateZone 1	807	3	19.96
model ext wall 2	787	8	7.75

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

U=0.12 Btu/ft^2*h*R U=0.68 w/m^2.k

Wall 3

Construction	Net Area (ft^2)	Surface Count	R Value (ft^2*h*R/Btu)
ASHRAE 189.1-2009 ExtRoof IEAD ClimateZone 1	807	3	19.96
model ext wall 3	787	8	2.36

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

U=2.38 Btu/ft^2*h*R U=2.38 w/m^2.k

CONCLUSION

As can be seen, the base wall is used in three cities, the building in Isfahan consumes the main energy for cooling but the Oslo which is located in the north of Europe and Piacenza consume the main energy for heating. The overall energy consumption between these three cities shows that Oslo uses main energy, after that is Piacenza and the last location where the building use least energy with the base wall characteristic is Isfahan.

Comparing the three walls in Piacenza show that the wall with insulation has a lowest U factor between the other walls which is shown less heat lost and also from the consumption chart it can be seen, the building with this characteristic use less energy.