TECHNICAL ENVIRONMENTAL SYSTEMS

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GROUP W20

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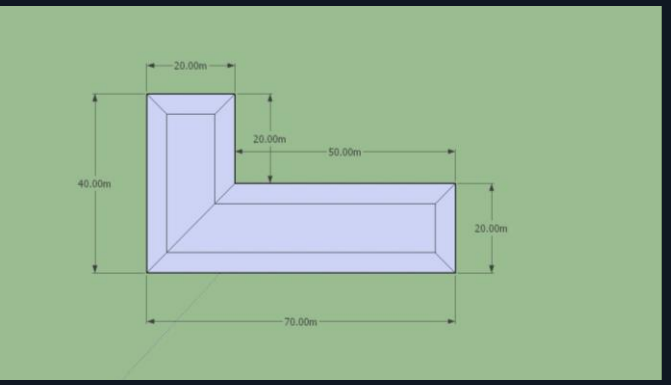
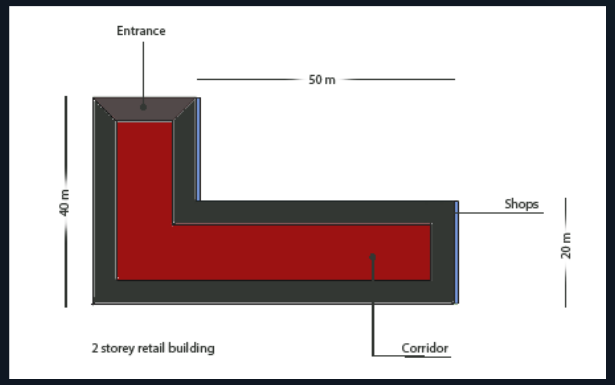
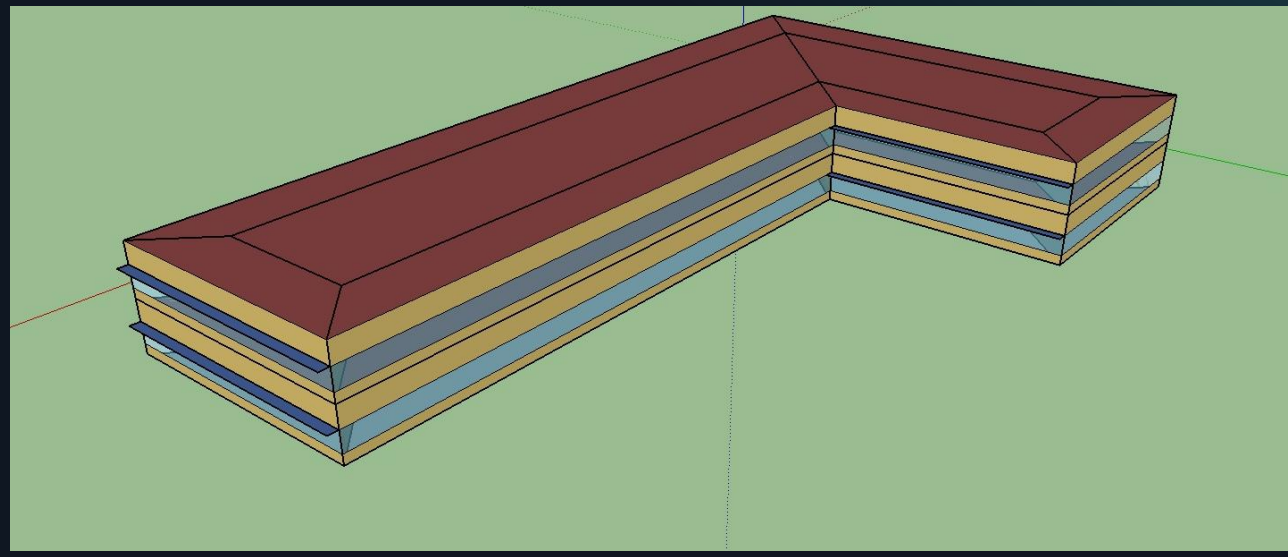




BUILDING DESIGN



RETAIL BUILDING

THE BUILDING IS DESIGNED IN TWO FLOORS AND HAS AN L SHAPE FORM . EACH FLOOR IS 4 METERS HIGH AND HAS AN AREA OF 1800 sq METER.

THE PURPOSE OF THE BUILDING IS THE COMMERCIAL.THE BUILDING INCLUDE 3 PARTS :

1) ENTRANCE

2) SHOPS

3) CORRIDOR

LOCATION

AVERAGE WEATHER DATA

- MILAN (NORTH PART OF ITALY) : 5-17 DEGREE AVG

MIN 2° - MAX 30°

- FLORENCE (MIDDLE PART OF ITALY) : 9-20 DEGREE AVG

MIN 2° - MAX 32°

- PALERMO (SOUTH PART OF ITALY) : 16-21 DEGREE AVG

MIN 9° - MAX 31°

WALL TYPES

WE CHOSE 3 DIFFERENT WALL COMPOSITIONS TO CONCLUDE WHICH ONE IS THE BEST OPTION FOR THE BUILDING .

1

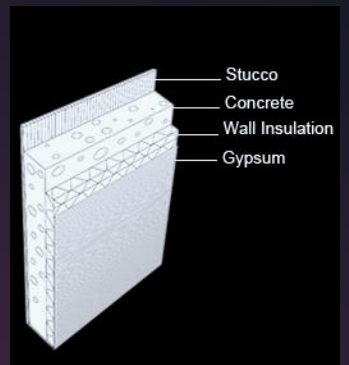
WALL 1

1 In Stucco

8 In CONCRETE

1 In WALL INSULATION [40]

I/2 In GYPSUM



2

WALL 2

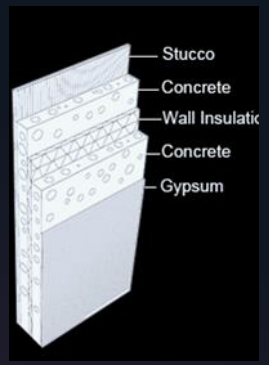
1 In Stucco

4 In CONCRETE

1 In WALL INSULATION [31]

4 In CONCRETE

I/2 In GYPSUM



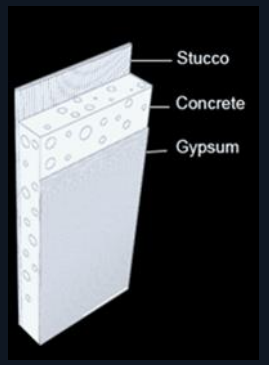
3

WALL 3 (BASE TYPE)

1 In Stucco ,

8 In CONCRETE

I/2 In GYPSUM



U-VALUES OF THE WALLS

U-VALUE CALCULATIONS

What is U-value?

The U-factor is the coefficient of heat transfer, which simply means it is a measure of the ability of an assembly to transfer thermal energy through its thickness. An assembly's U-factor is the inverse of the assembly's maximum R-value.

- $R_{total} = R_{inside\ surface} + R_{stucco} + R_{concrete} + R_{insulation} + R_{Gypsum} + R_{outside\ air}$
  $R_{total} = 0.12 + 0.037 + 0.12 + 1.83 + 0.079 + 0.03 = 2.216$
- $U = \frac{1}{R_{total}} = \frac{1}{2.216} = 0.45$

Material	Thickness (mm)	R- Value ($\frac{W}{m^2 °C}$)
Stucco	25	0.037
Concrete	200	0.12
Wall Insulation	80	1.83
Gypsum	12.5	0.079

- $R_{total} = R_{inside\ surface} + R_{stucco} + R_{concrete} + R_{insulation} + R_{concrete} + R_{Gypsum} + R_{outside\ air}$
  $R_{total} = 0.12 + 0.037 + 0.06 + 0.78 + 0.079 + 0.03 = 1.106$
- $U = \frac{1}{R_{total}} = \frac{1}{1.106} = 0.904$

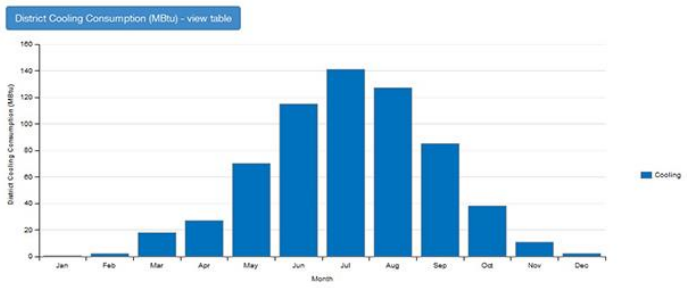
Material	Thickness (mm)	R- Value ($\frac{W}{m^2 °C}$)
Stucco	25	0.037
Concrete	100	0.06
Wall Insulation	34	0.78
Concrete	100	0.06
Gypsum	12.5	0.079

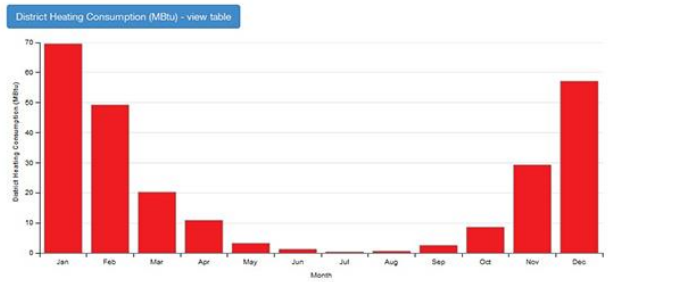
- $R_{total} = R_{inside\ surface} + R_{stucco} + R_{concrete} + R_{Gypsum} + R_{outside\ air}$
  $R_{total} = 0.12 + 0.037 + 0.12 + 0.079 + 0.03 = 0.386$
- $U = \frac{1}{R_{total}} = \frac{1}{0.386} = 2.590$

Material	Thickness (mm)	R- Value ($\frac{W}{m^2 °C}$)
Stucco	25	0.037
Concrete	200	0.12
Gypsum	12.5	0.079

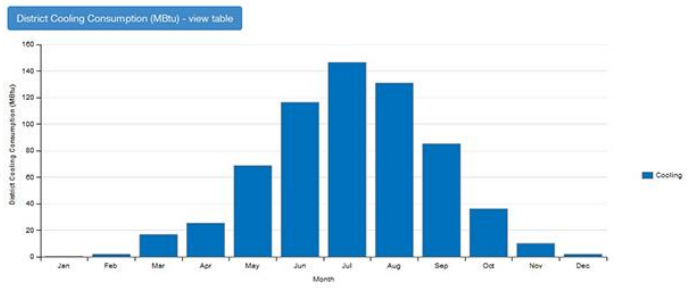
MILAN (MONTHLY ANALYSIS) : HEATING & COOLING

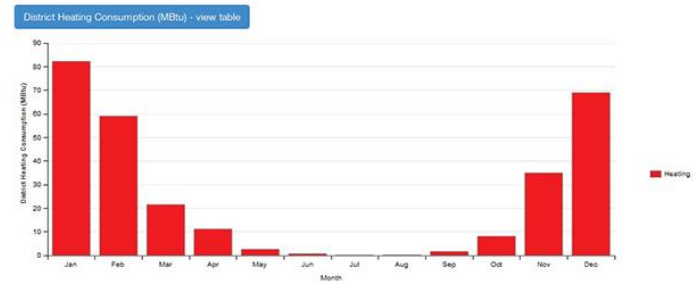
WALL 1



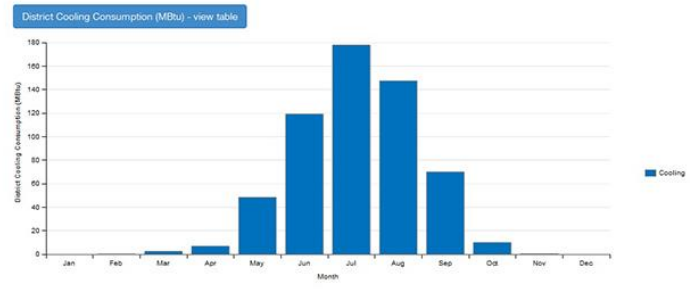


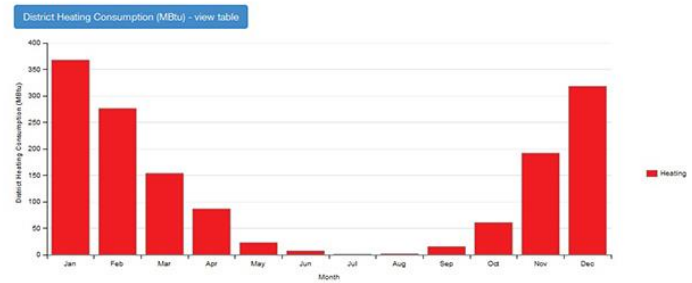
WALL 2



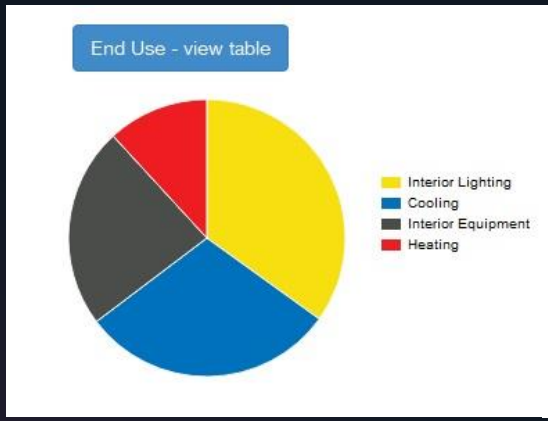
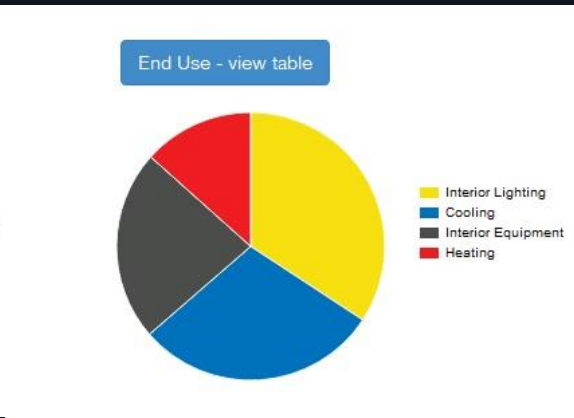
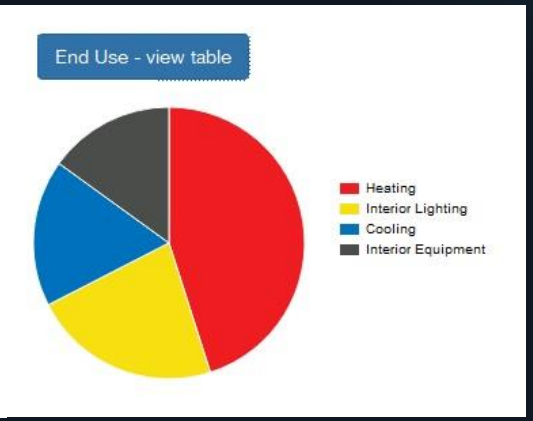


WALL 3



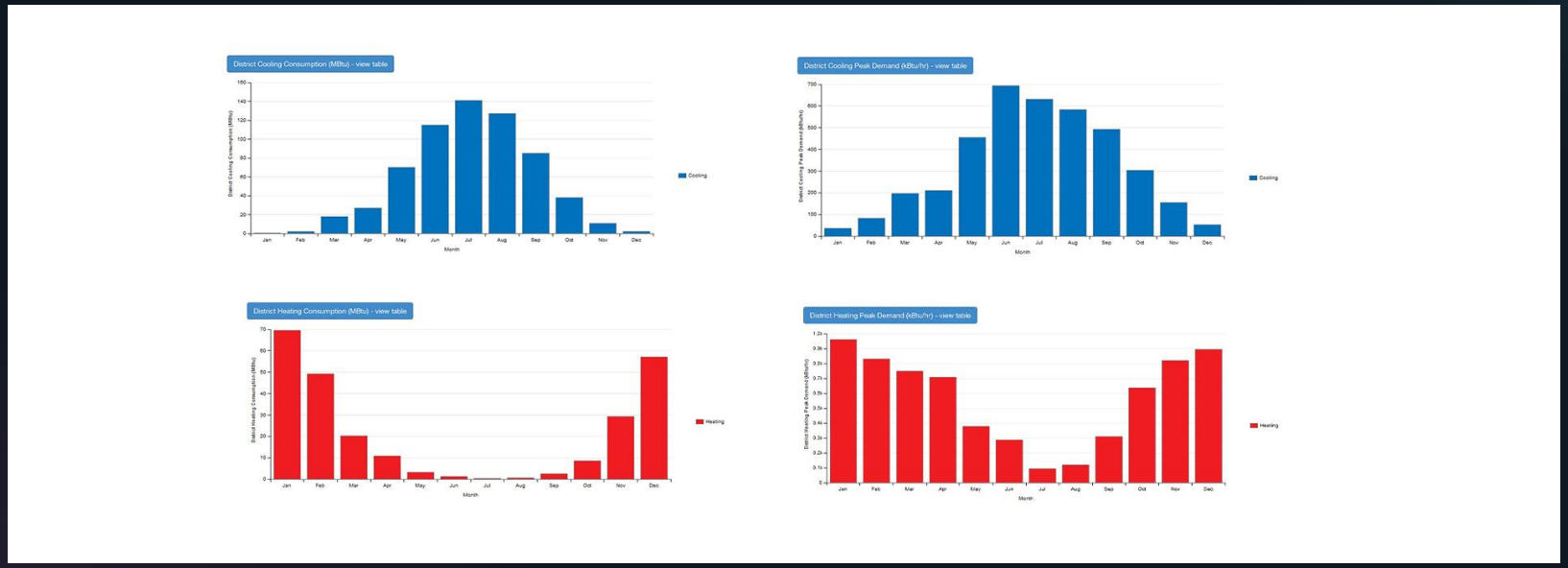


How material affects the energy consumption for heating and cooling in Milan

	Wall 1	Wall 2	Wall 3
			
HEATING (kBtu) :	252.686	291.416	1501.911
COOLING (kBtu) :	636.478	639.758	582.519

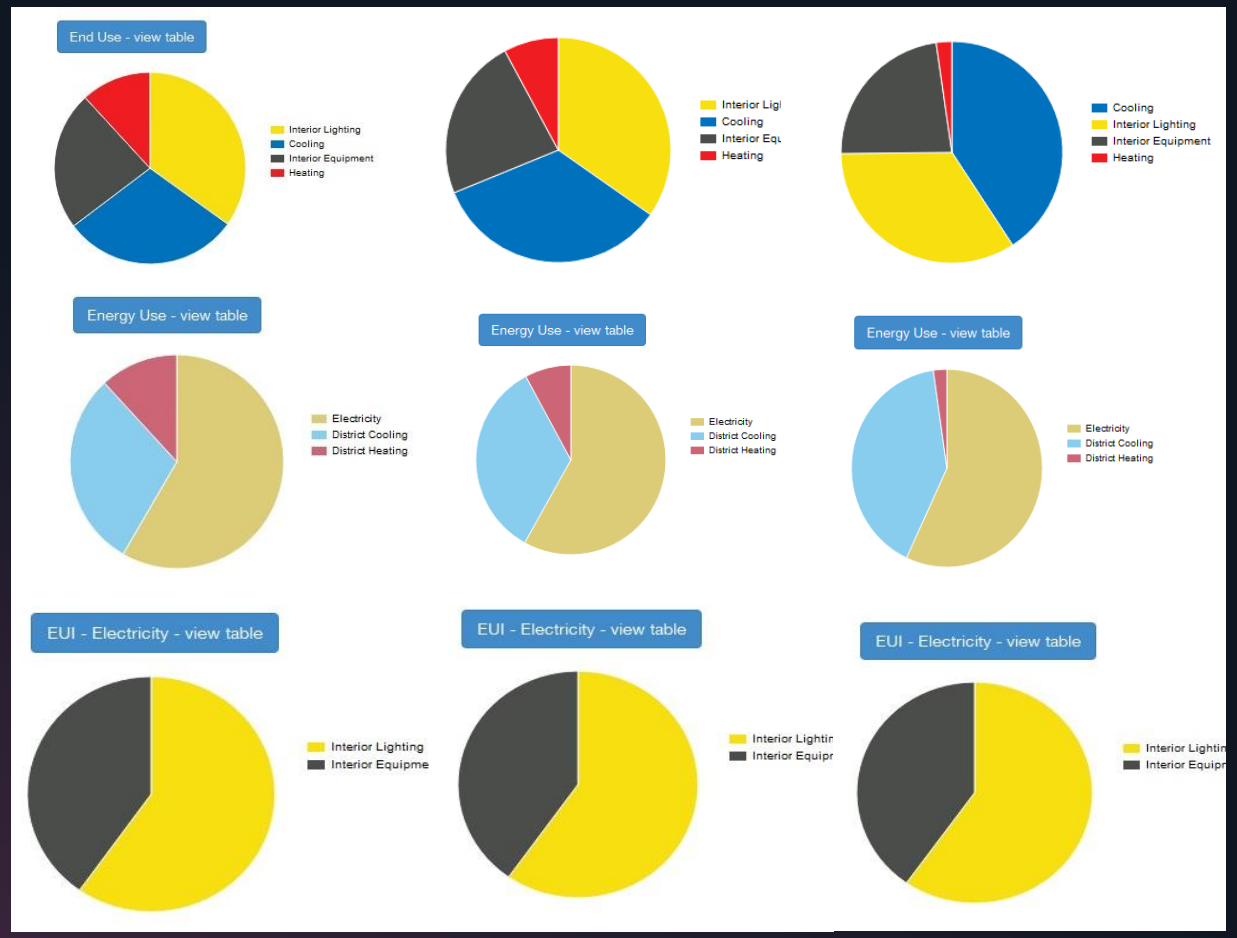
WALL I (MONTHLY ANALYSIS) : MILAN

Summer months being June to August, the district cooling consumption is more in these months and highest being in the July month(141 MBtu approximately). And district cooling peak demand being highest in June(693 kBtu/hr approximately).



Winter months being beginning of November to almost the end of February , the district heating consumption is more in four months and highest being in the month of January(70 MBtu approximately) and district heating peak demand being highest in January month(1.0k kBtu/hr approximately).

MILAN FLORENCE PALERMO



COMPARATIVE STUDY (Annual overview) :

MILAN | FLORENCE | PALERMO

We tested wall 1 construction in three different cities to show how weather affects the energy consumption for heating and cooling.

	MILAN	FLORENCE	PALERMO
HEATING	252.686	168.749	49.827
COOLING	638.478	732.018	893.062
TOTAL CONSUMPTION (kBtu)	889.164	900.767	942.889

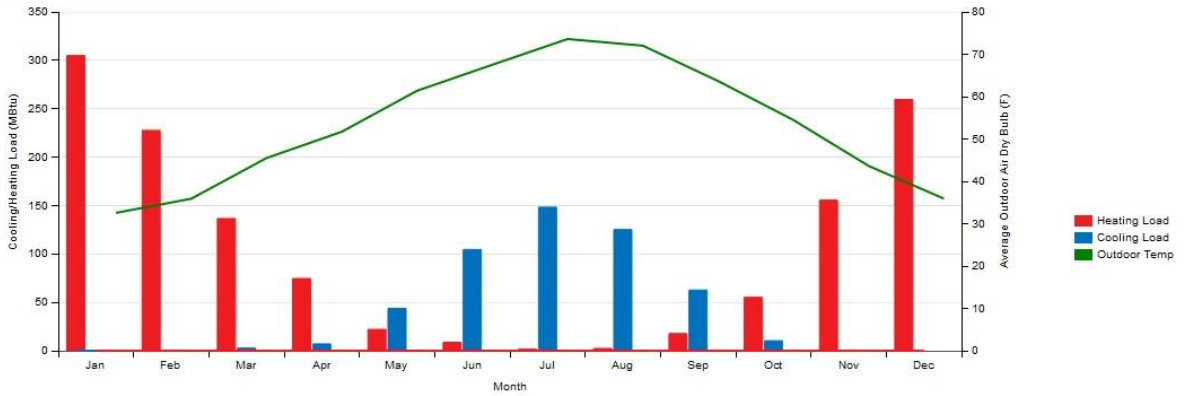
COMPARATIVE STUDY

(Annual overview) : MILAN | FLORENCE | PALERMO

Based on the weather data that we imported into the software , it is automatically calculated the amount of heating and cooling we need for each month of the year

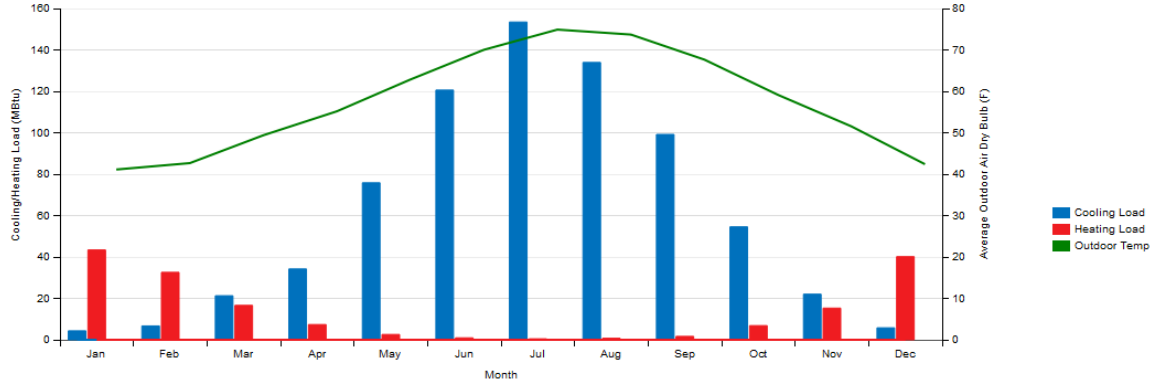
MILAN

Monthly Load Profiles - view table



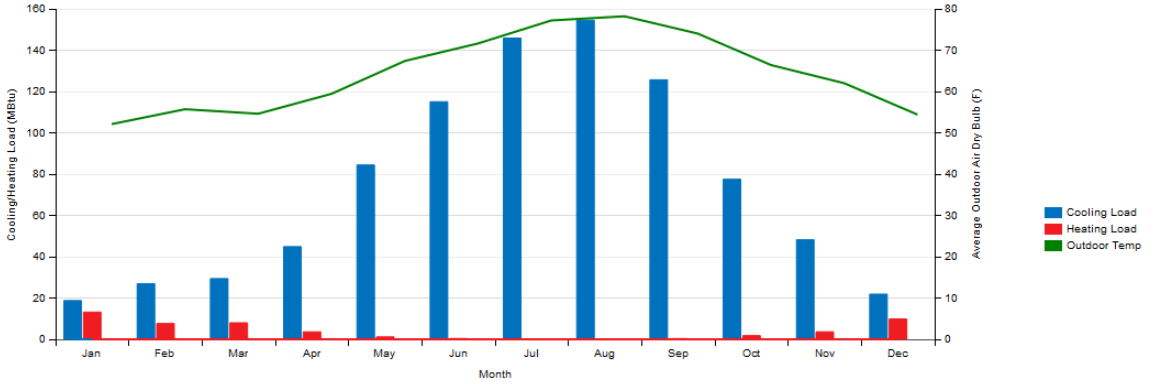
FLORENCE

Monthly Load Profiles - view table



PALERMO

Monthly Load Profiles - view table



ENERGY PLUS DATA

MILAN

FLORENCE

PALERMO

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	3186.03	885.01	885.01
Net Site Energy	3186.03	885.01	885.01
Total Source Energy	9561.19	2655.89	2655.89
Net Source Energy	9561.19	2655.89	2655.89

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	2267.01	629.72	629.72
Net Site Energy	2267.01	629.72	629.72
Total Source Energy	5628.44	1563.46	1563.46
Net Source Energy	5628.44	1563.46	1563.46

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	2311.44	642.07	642.07
Net Site Energy	2311.44	642.07	642.07
Total Source Energy	5354.44	1487.35	1487.35
Net Source Energy	5354.44	1487.35	1487.35

THANK YOU!