ENERGY AND ENVIRONMENTAL TECHNOLOGIES FOR BUILDING SYSTEMS

OPEN STUDIO PROJECT

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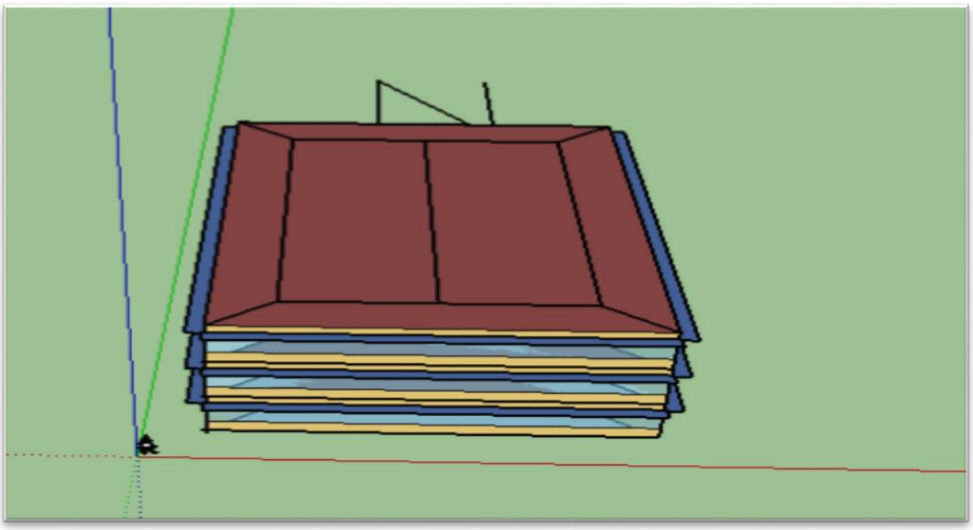
ABSTRACT



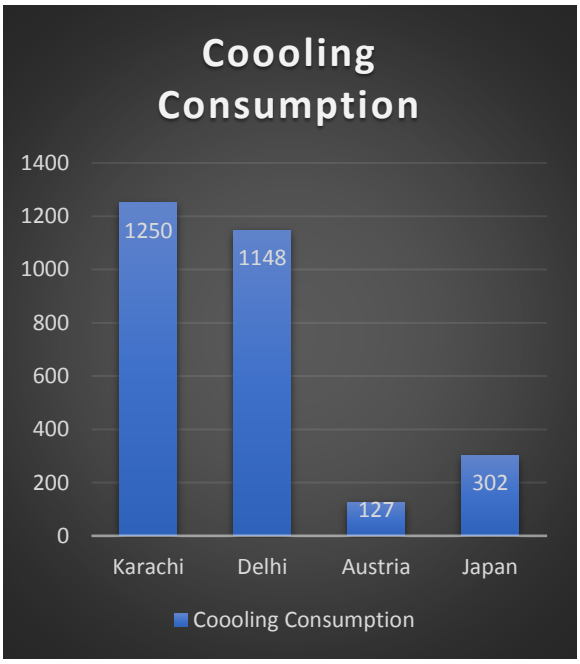
This building model has been developed in sketch-2016 software.

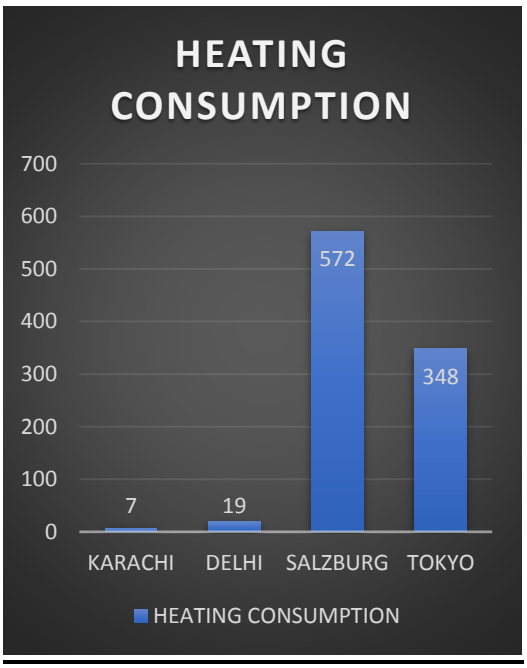
Initially, the building is framed geometrically. Later, by using different tools it is partitioned according to thermal zones for multi-purpose use. Then the model is being developed and open studio is used for building load calculations. It Modifications, if required, can be done in open studio.

1. A building with 20m x 30m dimensions has been modelled for building this project.
2. It is a three-storied building with different thermal zones on every floor & several areas.
    i. **First Story** - IT Room, Open Area, Break Room & Corridor
    ii. **Second & third Story** - Open Offices & Conference Rooms
3. We have worked on 4 cities (Karachi, New Delhi, Tokyo, Salzburg) from different regions across world so that a better comparison can be made.

TABLE-1: HEATING & COOLING CONSUMPTION OF CITIES

LOCATION	COOLING CONSUMPTION (GJ)	HEATING CONSUMPTION (GJ)
KARACHI-PAK	1250	7
DELHI-INDIA	1148	19
SALZBURG-AUSTRIA	127	572
TOKYO-JAPAN	302	348



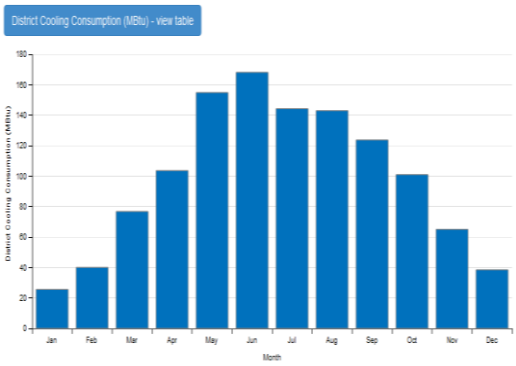


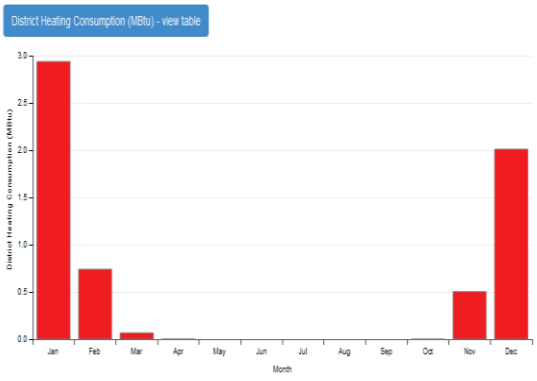
ANALYZING POINTS

1. It is depicted in above graphs that;
   i. Cooling consumption of south Asian countries like PAKISTAN & INDIA is almost 90%. On contrary part, heating consumption is negligible for these parts of the world.
   ii. Similarly, cities from AUSTRIA & JAPAN share very small proportion of the cooling load compared to their huge heating consumption.

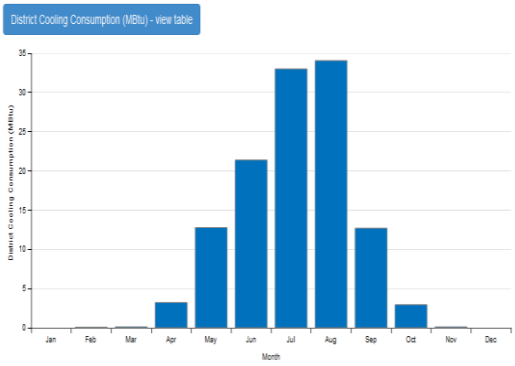
2. It can be analyzed from above graphs that,
   i. Such a huge load difference among these places is affected by different factors like sun exposure, day-length, relative-humidity.

KARACHI





SALZBURG



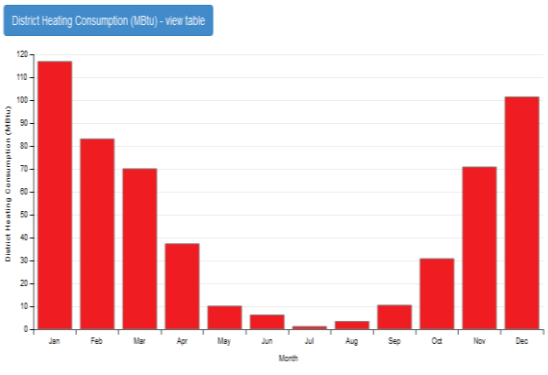
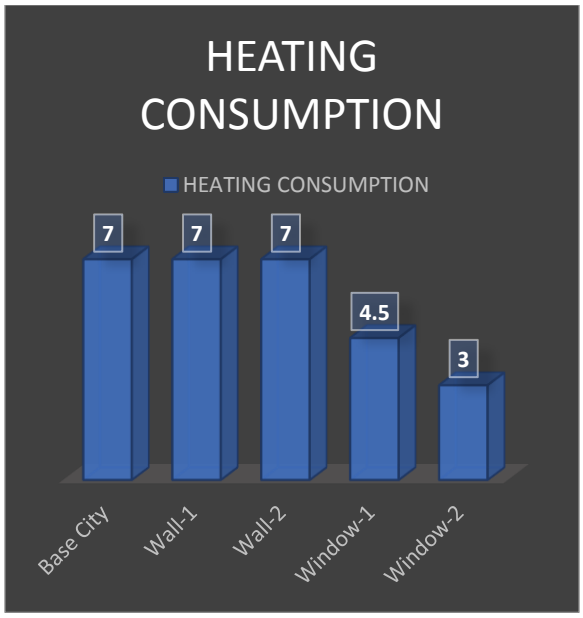


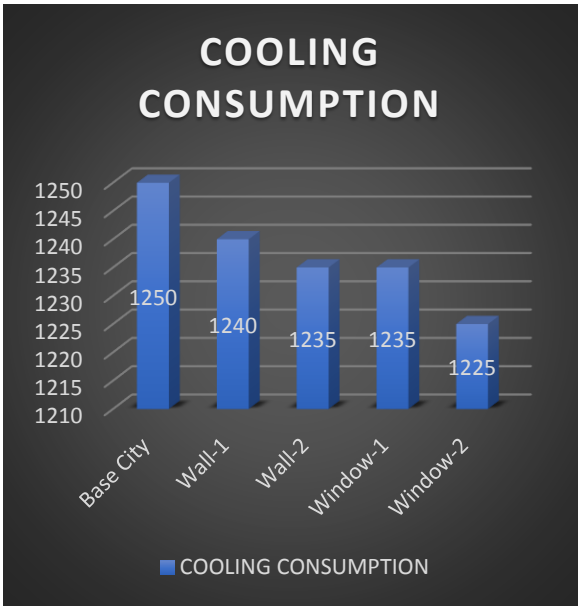
Table-2: Heating & Cooling Consumption with modified features

The modifications made are as tabulated below:

Area	Original	1st modification	2nd modification
External wall	1-inch stucco 8-inch concrete HW **8 in wall insulation [31]** ½ N Gypsum	**Wall insulation [35]**	**Wall insulation [36]**
Window	Theoretical glass [167]	Theoretical glass [197]	Theoretical glass [202]

Modification	COOLING CONSUMPTION (GJ)	HEATING CONSUMPTION (GJ)
KARACHI-Wall-1	1240	7
KARACHI-Wall-2	1235	7
KARACHI-Window-1	1235	4.5
KARACHI-Window-2	1225	3





ANALYZING POINTS

1. In above line-representations, a comparative study has been done taking Karachi as a Base-City & modifying it is walls & windows.

2. However, these modifications don't affect the cooling load much but makes a difference for heating load of building.

CONCLUSION

The distance from the equator affects the climate of a place. At the poles, energy from the sun reaches the Earth's surface at lower angles and passes through a thicker layer of atmosphere than at the equator. This means the climate is cooler further from the Equator. The distance of places which we have considered in our project increases from Karachi to that for Salzburg i.e. Karachi is the closest and Salzburg farthest from the equator. As it is very evident from the graphs obtained, that the heating and cooling consumptions vary for different regions based on their distance from equator which in turn affects the climate of a place.

It is concluded that environmental conditions and building construction type play a major role in calculations of building loads as shown in the graphs.