OPEN STUDIO REPORT

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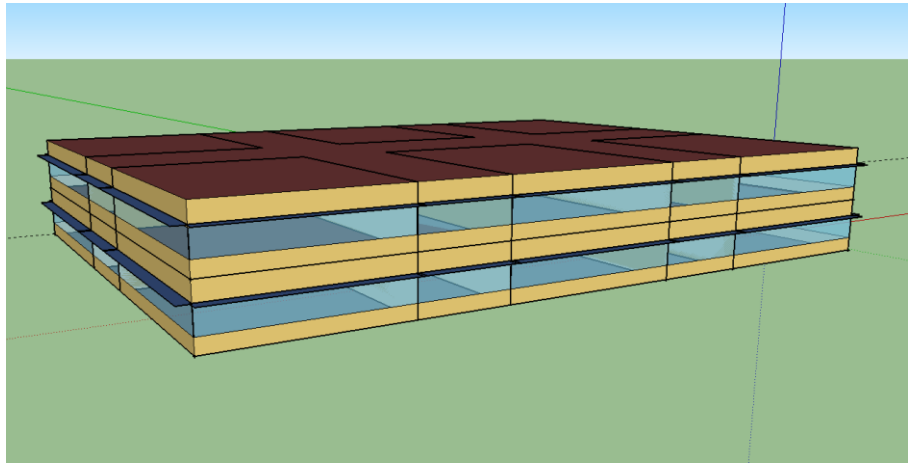
Building characteristics



ANDINO MALL	AREA
Gross Wall Area [m2]	853.44
Window Opening Area [m2]	341.38
Gross Roof Area [m2]	1200.00

The commercial building considered in this project has two stories in total, each floor has the same area of construction, which is divided in: 6 stores and corridor, having two different thermal zones.

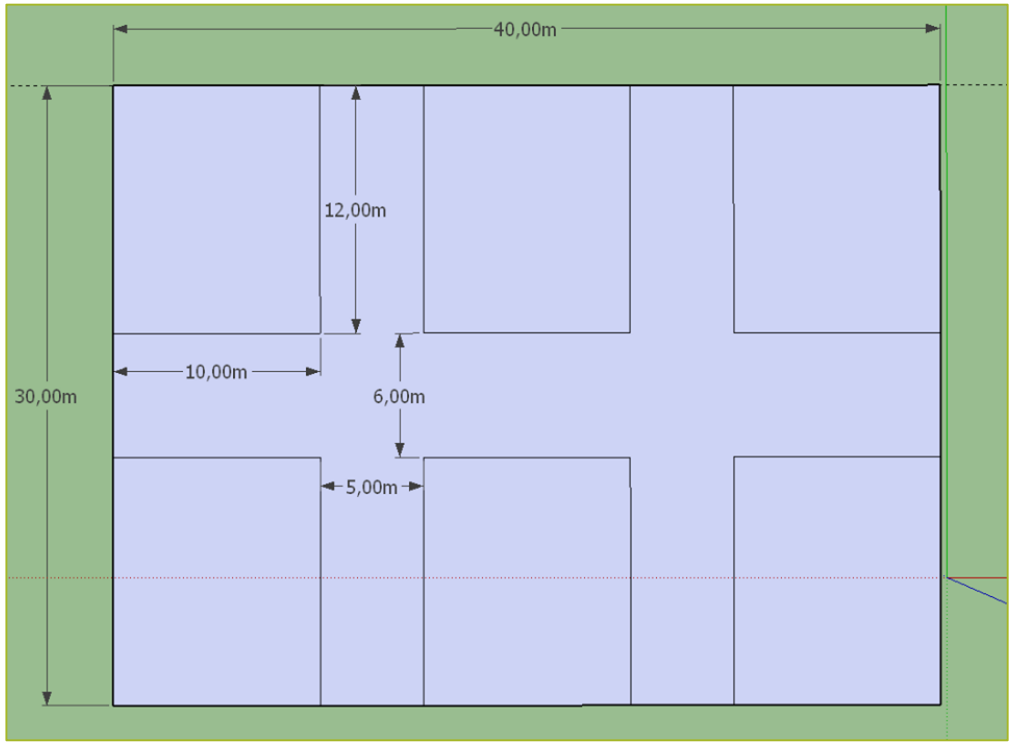
Windows in each floor and in all directions.

40% of fenestration rate is considered in all the walls.

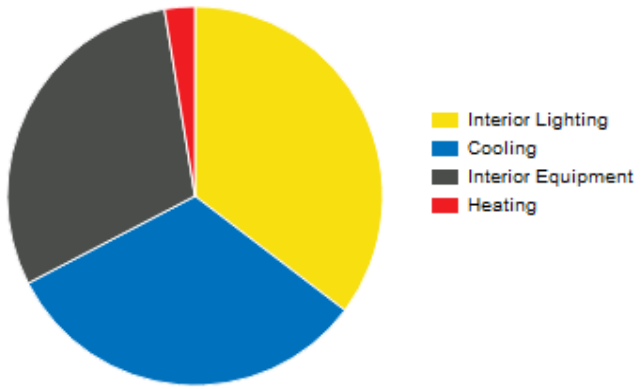
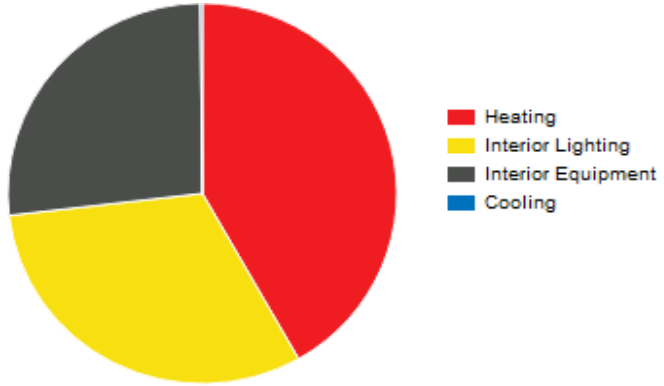
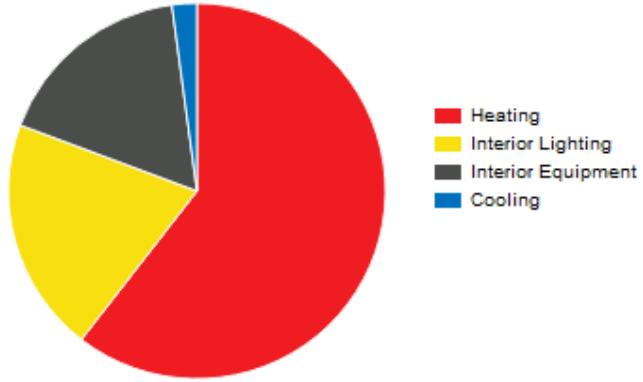
Shading in all windows, except for the north orientated ones.

Building specification

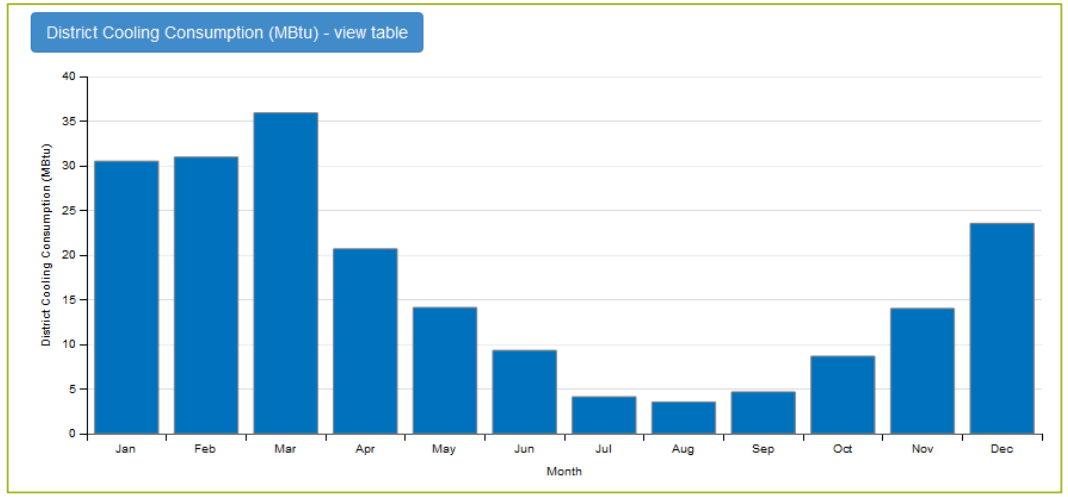
Area [m2]	Conditioned (Y/N)	Window Glass Area [m2]	Lighting [W/m2]	People [m2 per person]
THERMAL ZONE 1	720.00	329.18	131.67	10.6563
THERMAL ZONE 2	480.00	97.54	39.01	4.8438
THERMAL ZONE 3	720.00	329.18	131.67	10.6563
THERMAL ZONE 4	480.00	97.54	39.01	4.8438
Total	2400.00	853.44	341.38	8.3313
Conditioned Total	2400.00	853.44	341.38	8.3313

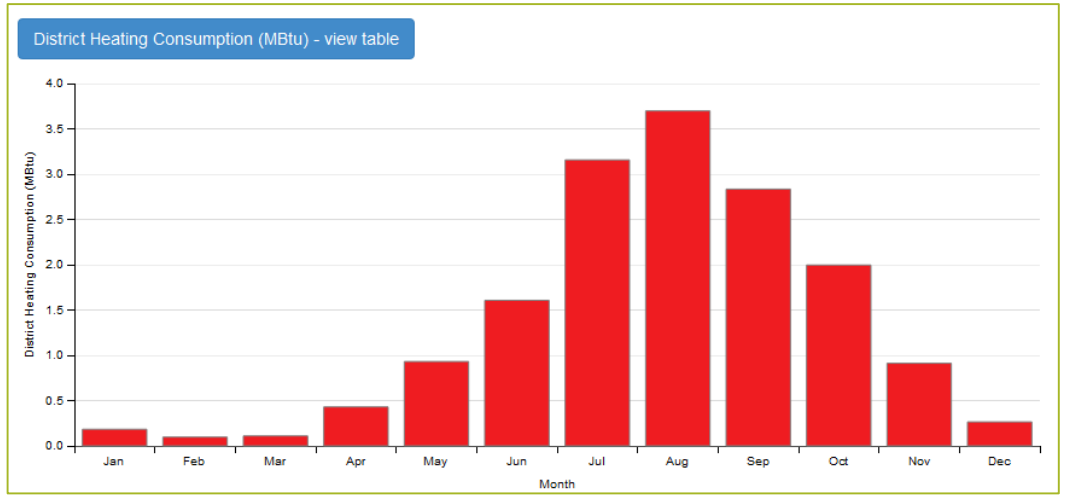


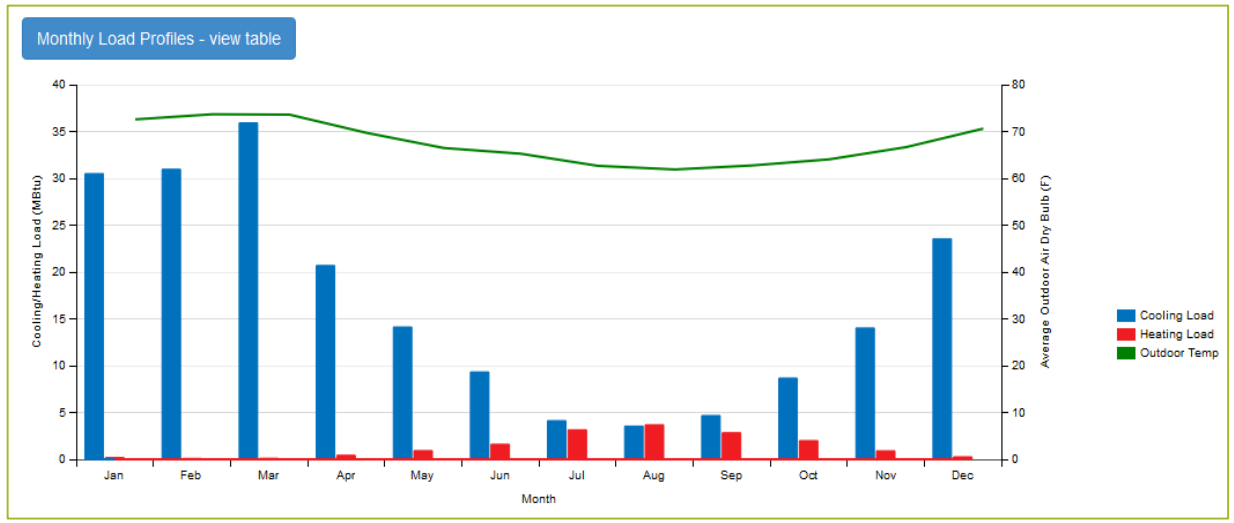
Information	Lima	La Paz	Stockholm
Latitude	-12.0	-16.5	59.65
Longitude	77.1	-68.2	17.95
Elevation [ft]	43	13261	200
Time Zone	-5.0	-4.0	1.00
Net Site Energy [kBTU]	623,427	701,081	1,089,013

End Use: LIMA	End Use: LA PAZ	End Use: STOCKHOLM
		
We can conclude that about 32,10% of the end use is for space cooling (211,14 GJ) due to a DB Temp 28,3°C, whereas 2,60% is for space heating (17, 12 GJ). However, the interior lightning and equipment have the highest end-use 429.50 GJ, 35,30% and 30% respectively.	With a DB Temp = -3,1°C in Winter, space heating is around 42% (308.94 GJ). Nevertheless, electricity is still higher with 58%. No need to use cooling system as the temperature in summer is 16,8°C.	In this case, it is evident that space heating is is the end use with the higher energy consumption with 60,49% (695.07 GJ) due to its DB Temp = -15°C, whereas the district cooling is just 2,12% (24,20GJ). For the Interior lightning and Receptacle equipment are just 20,21% and 17,18% respectively.

LIMA: Distric Consumption / HVAC Load Profile

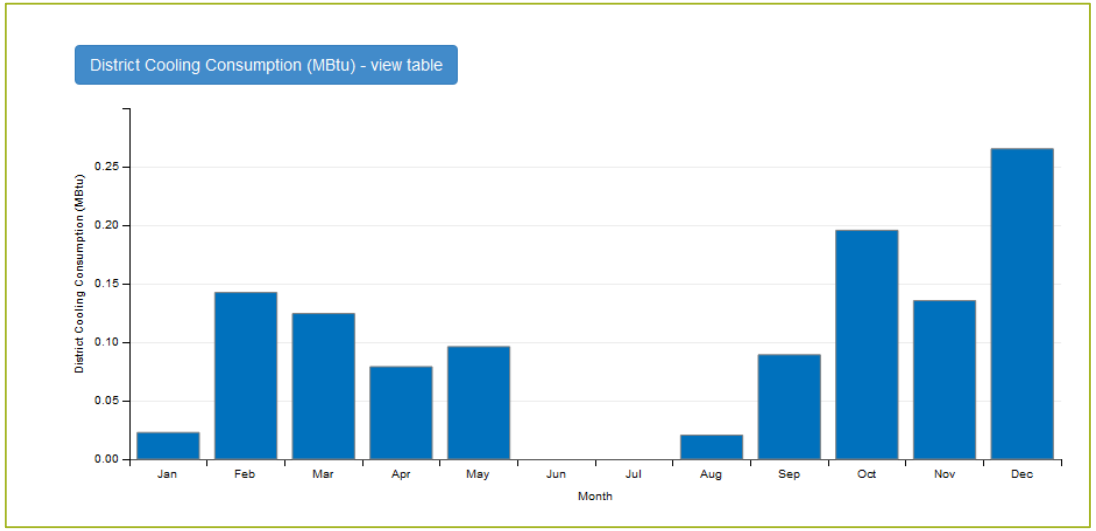


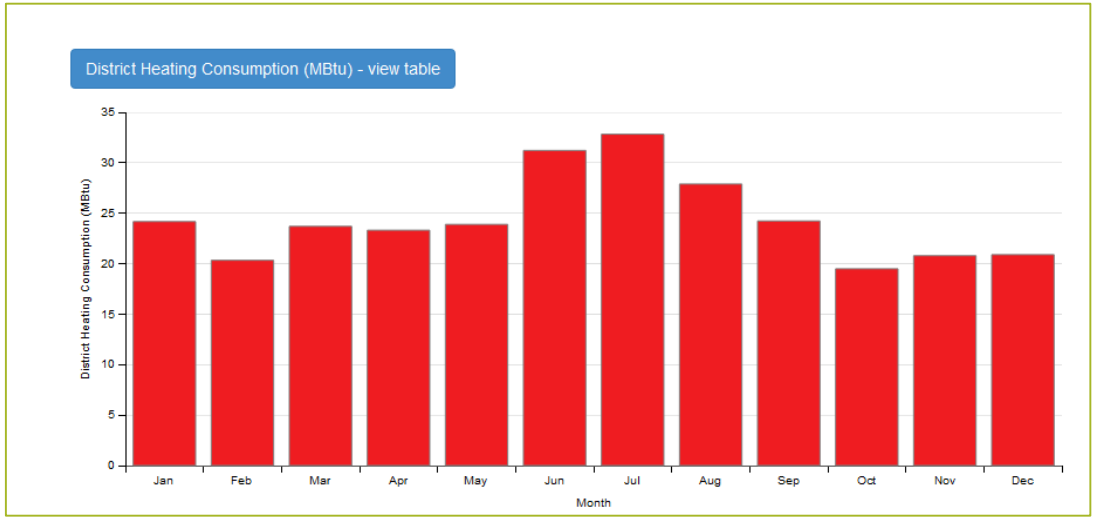


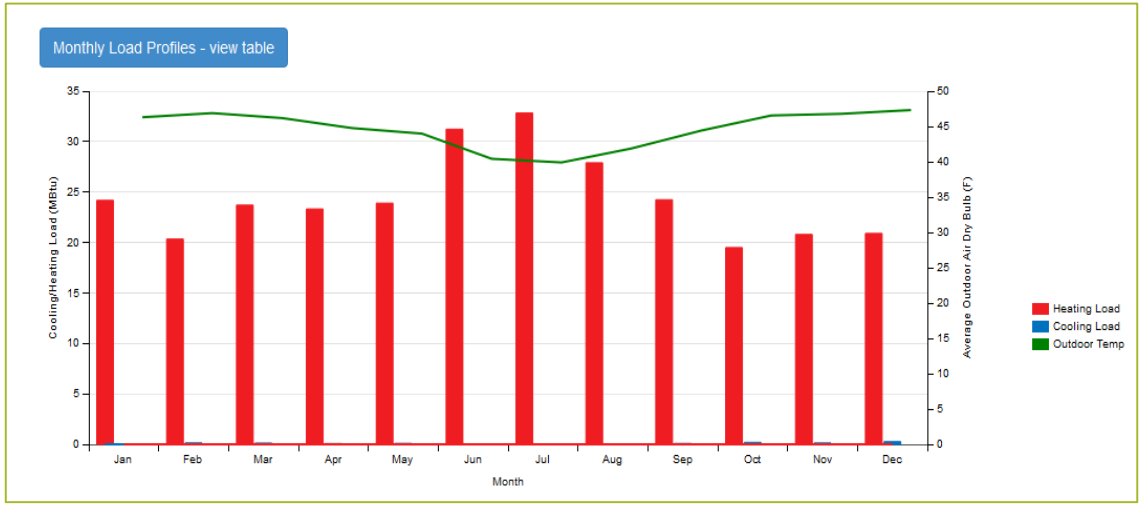


- We can observe the yearly variation of the cooling consumption, being March the hottest month, increasing up to 36 MBTU for cooling. Meanwhile, for Winter, being August the coldest month, it is just required 10% of the cooling system: 3,6 MBTU.
- The outside temperature varies from 25°C to 35°C during the whole year.

LA PAZ: District Consumption / HVAC Load Profile

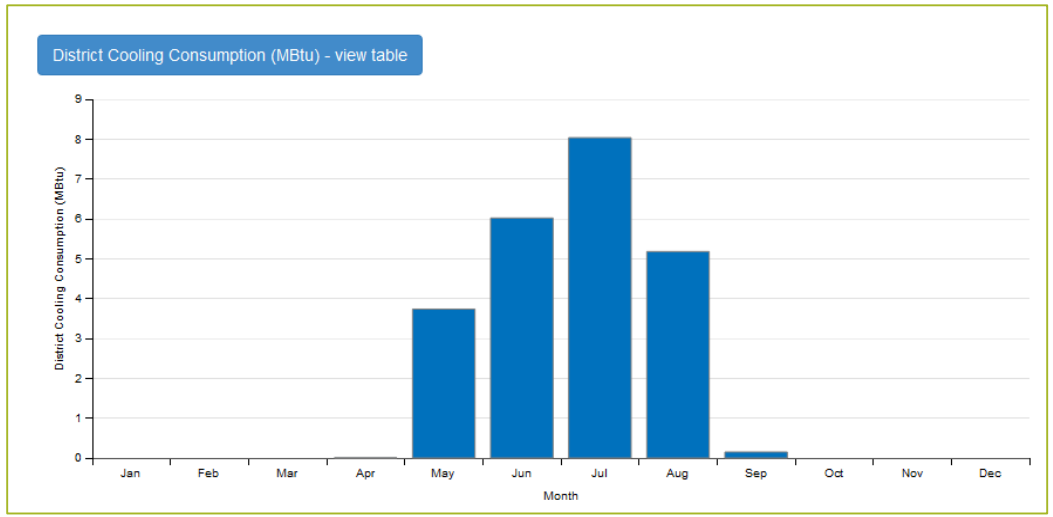


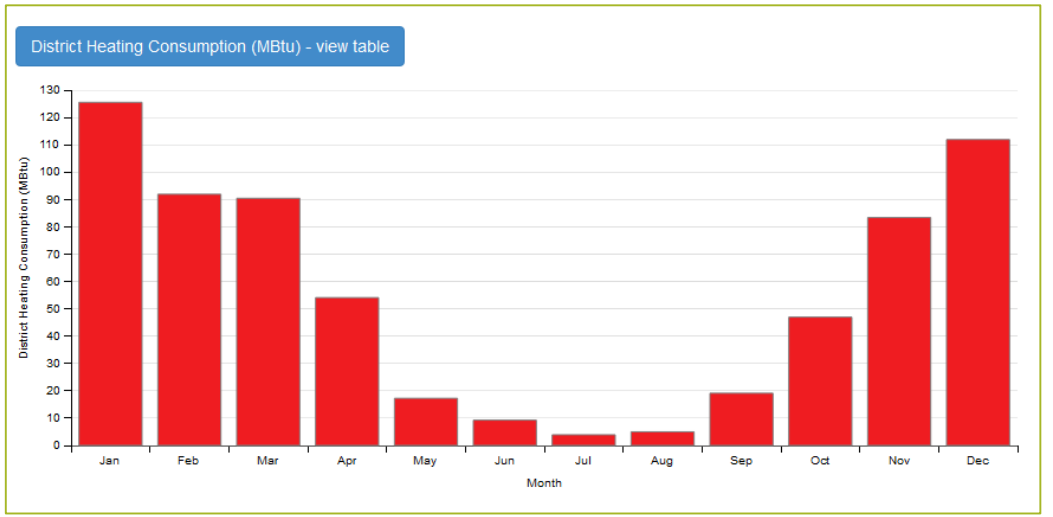




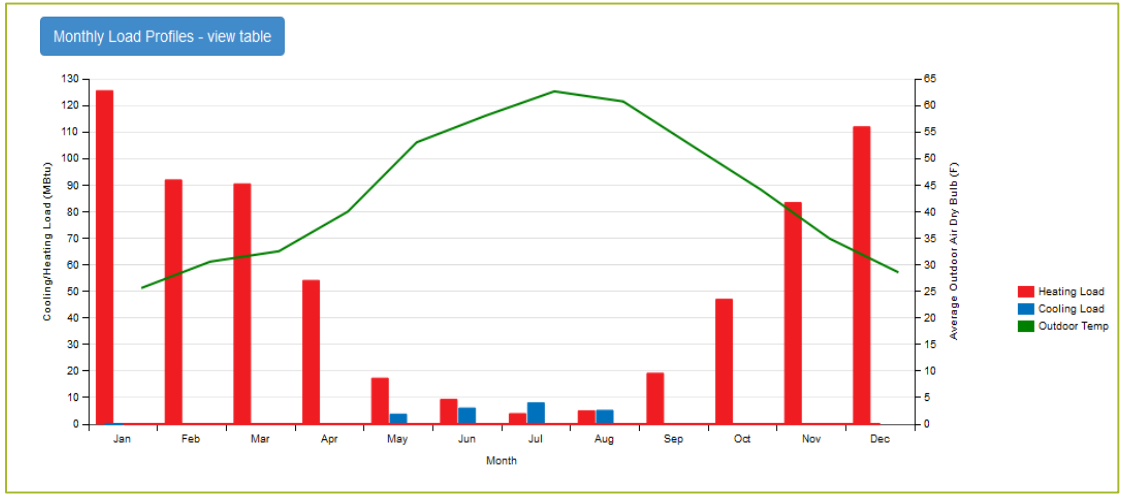
- The yearly average outside temperature varies from 4°C up to 10°C. Therefore, the load heating system is high, being almost constant during the whole year.
- As can be seen cooling system is not neccesary.

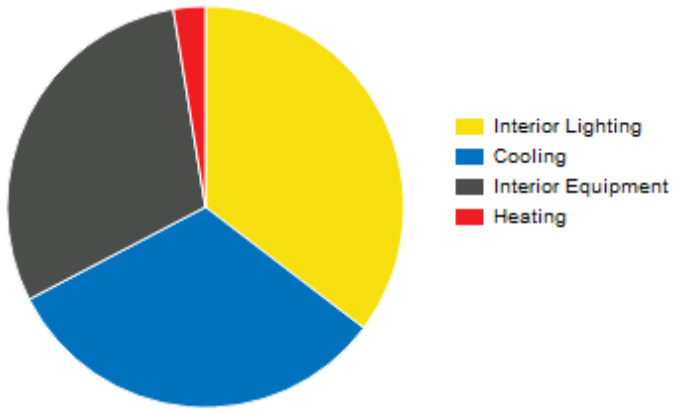
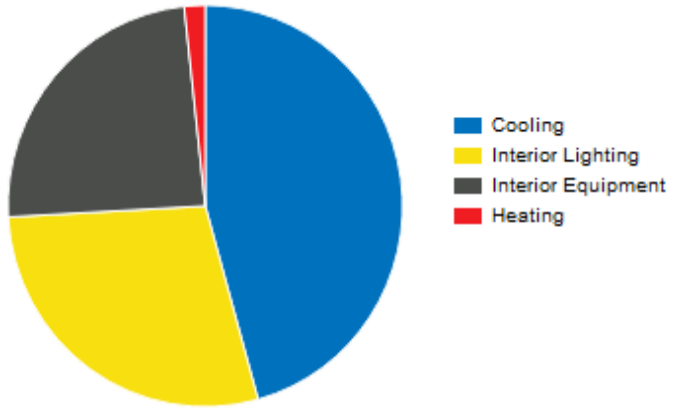
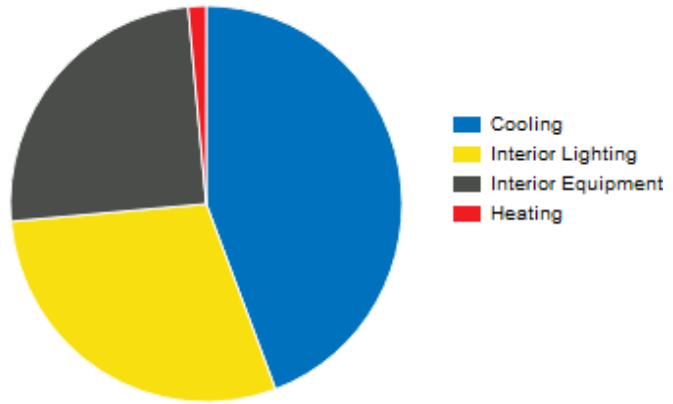
STOCKHOLM: District Consumption / HVAC Load Profile



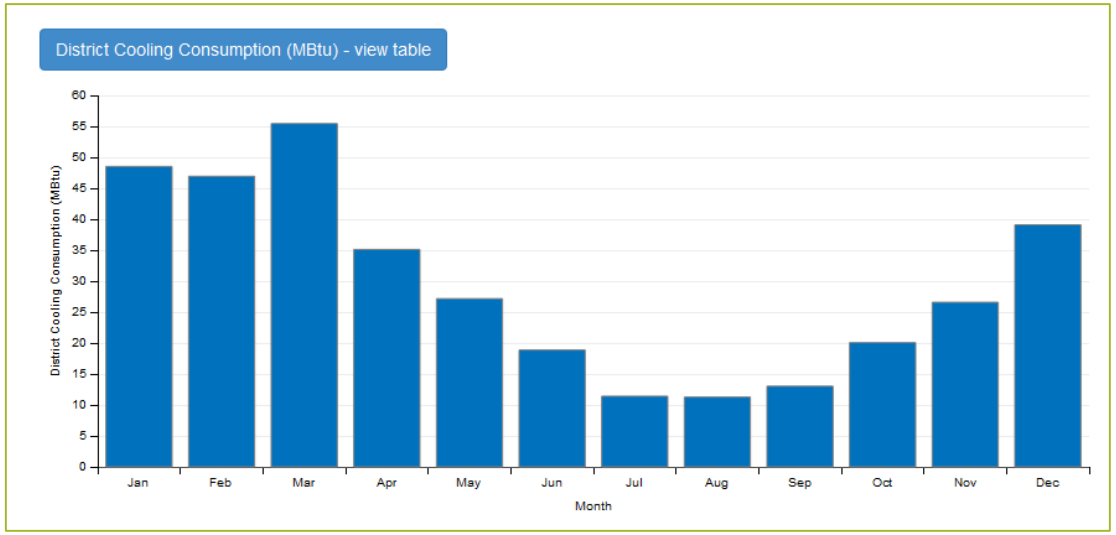


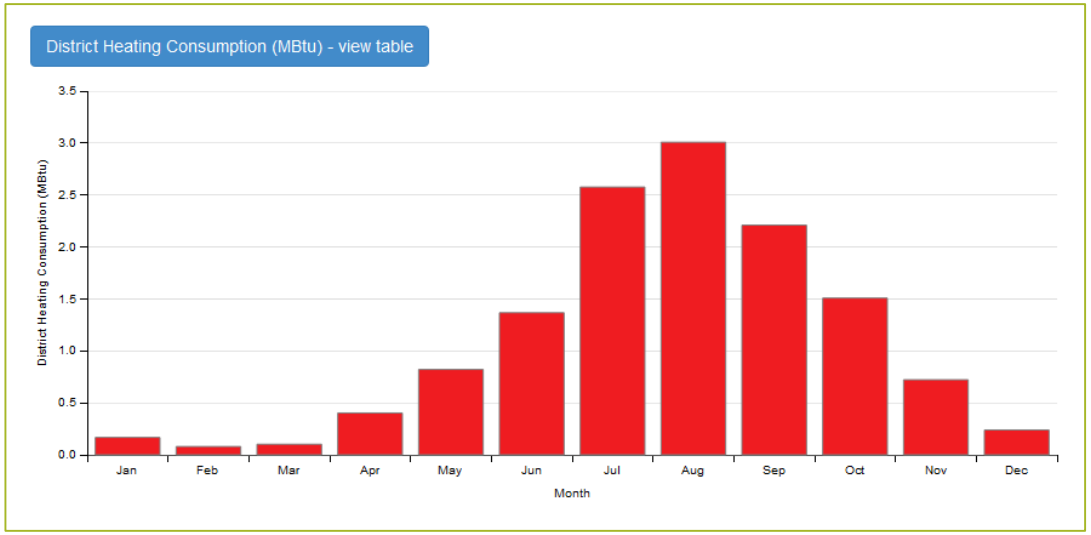
- For this case, around 8 MBTU are required for cooling in the hottest month, whereas for heating during Winter is needed up to 120 MBTU.



End Use: LIMA BASE CASE	End Use: WALL 2	End Use: WALL 3
		
We can conclude that about 32,1% of the end use is for space cooling (211,14 GJ) due to a DB Temp 28,3°C, whereas 2,6% is for space heating (17,12 GJ). However, the interior lightning and equipment have the highest end-use: 429.51 GJ, 35,3% and 30% respectively, being the total site energy 657,75 GJ. While the U-Factor of the wall is 0,591 W/m2-K.	The total site energy is 816.43 GJ where it can be divided into cooling load 372.99 GJ with an increase of 76,66% wrt the base case and a heating consumption of 13,93 GJ with a decrease of 18,63%. This is due to the fact that the U-Factor of the wall is 1,602 W/m2-K.	For this case, the U-Factor of Wall is 0.767 W/m2-K, increasing the total site energy up to 791.2 GJ. It can be seen that the District Cooling is 350.10 GJ, about 44.25 % of the total, 65,8% more than the base case. Whereas, the District Heating is 11,65 GJ, about 1,5 % of the total, 31,95% less than the base case.

LIMA: Distric Consumption – WALL CASE 2

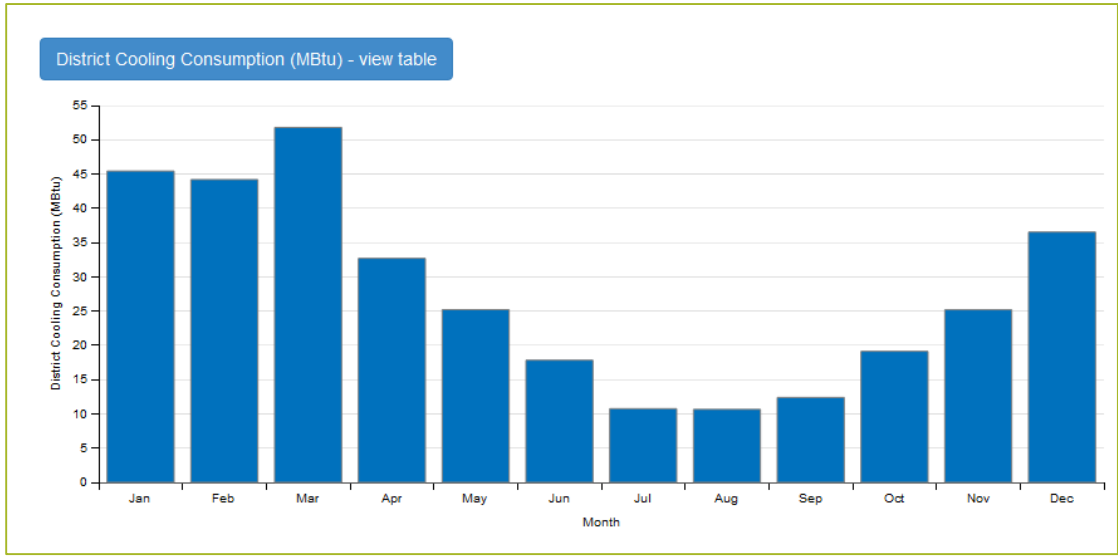


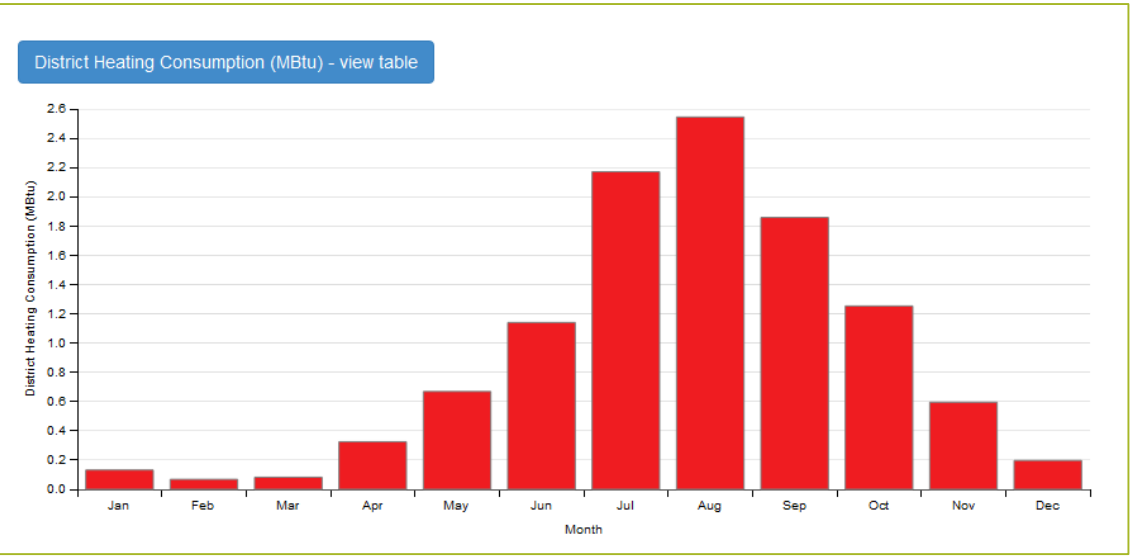


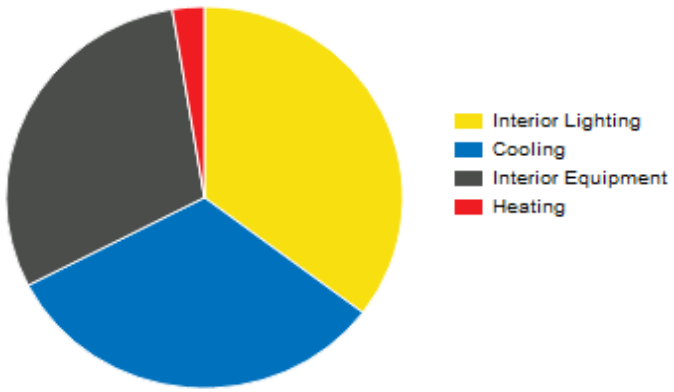
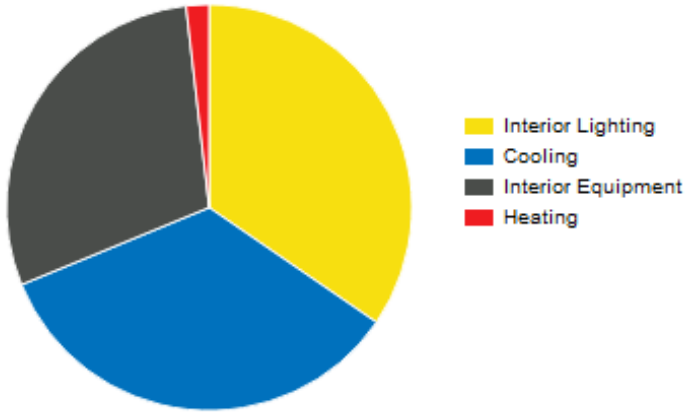
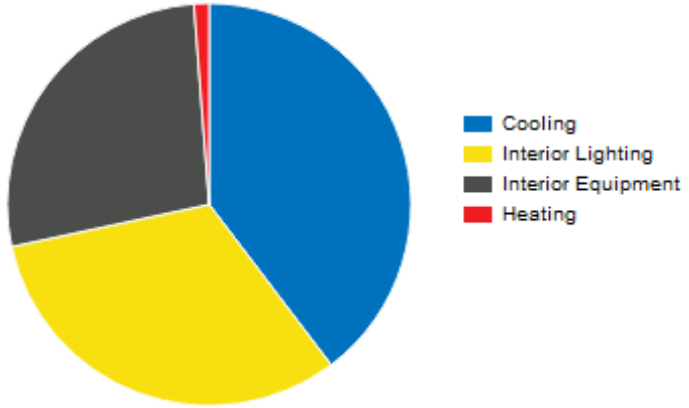
- If the Wall configuration is changed by an air gap instead of an insulation layer, capital costs are reduced. However, it can be seen that the Cooling consumption is increased significantly (56MBTU for the hottest month) due to the convection losses.
- The reduce for heating consumption is minor in comparison with the cooling load.

LIMA: District Consumption – WALL CASE 3

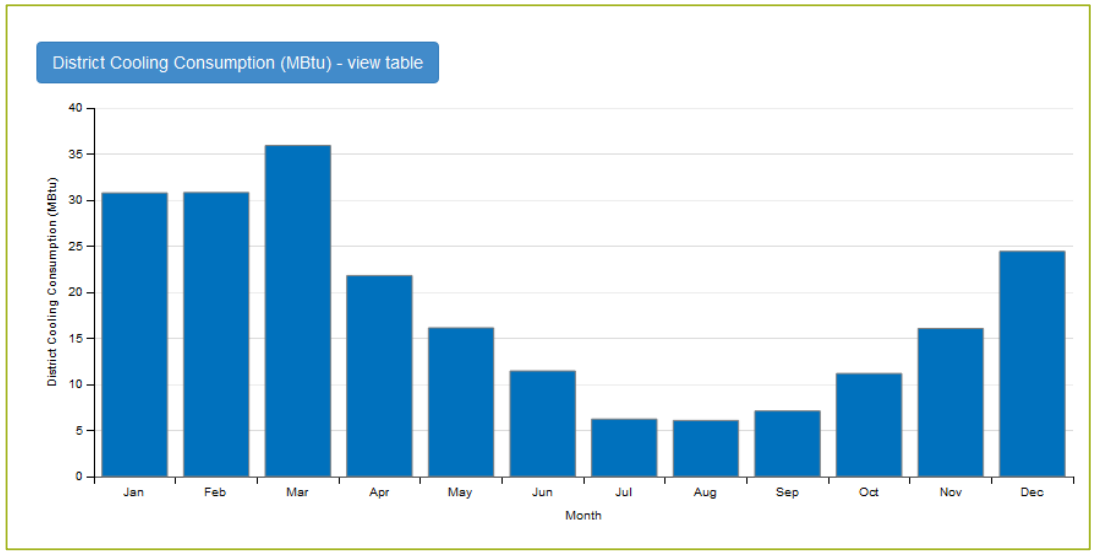
- The Wall # 3 is designed with cheaper materials. Unfortunately, reducing investment costs implies an increase in the convection losses, rising the cooling consumption each month.
- Once again, the decrease on Heating Consumption is not significant.

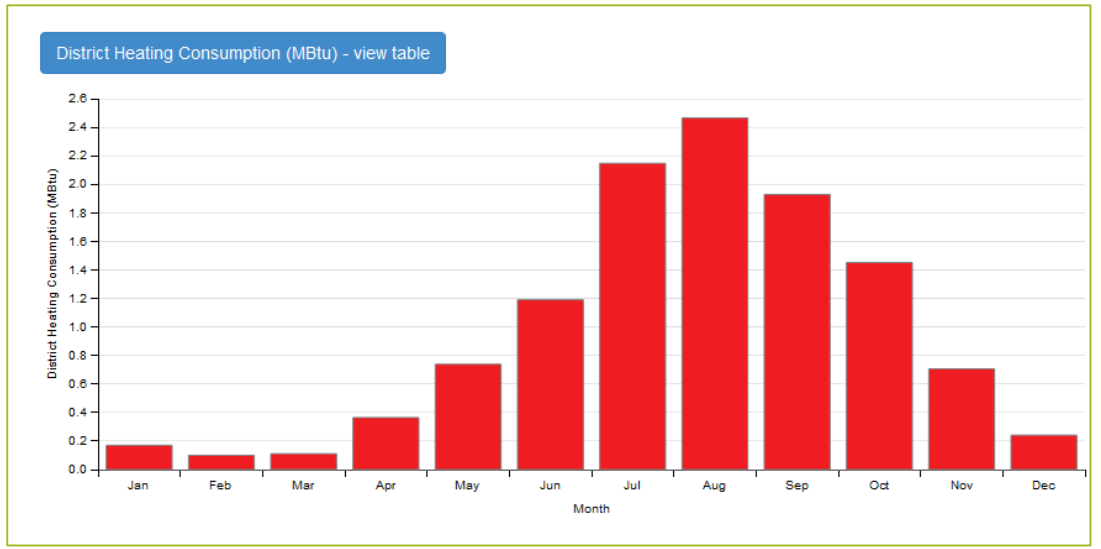




End Use: LIMA BASE CASE	End Use: GLAZING 2	End Use: GLAZING 3
		
As we saw previously, about 32,10% of the end use is for space cooling (211,14 GJ), whereas 2,60% is for space heating (17,12 GJ); being the total site energy 657,75 GJ. Glass U-Factor: 6,424 W/m2-K, SHGC: 0,252 and Glass Visible Transmittance: 0.252.	For this case, it is considered to have: Glass U-Factor: 3.122 W/m2-K, SHGC: 0.252 and Glass Visible Transmittance: 0.320. The total site energy is 671.82 GJ and the total source energy is 1647.38 GJ. 230.06 GJ is for space cooling, increasing 8,96% wrt the base case. Whereas, 12.25 GJ is for space heating, 28,44% less than the base case.	The total site energy is 726.51 GJ and the total source energy is 1696.10 GJ. The district cooling is 288.28 GJ, 36,54% more than the base case; whereas for heating is a lower value (8,73 GJ), decreasing 49%. This case has a glazing with U-Factor of 1.984 W/m2-K and visible transmittance of 0.452.

LIMA: District Consumption – GLASS CASE 2

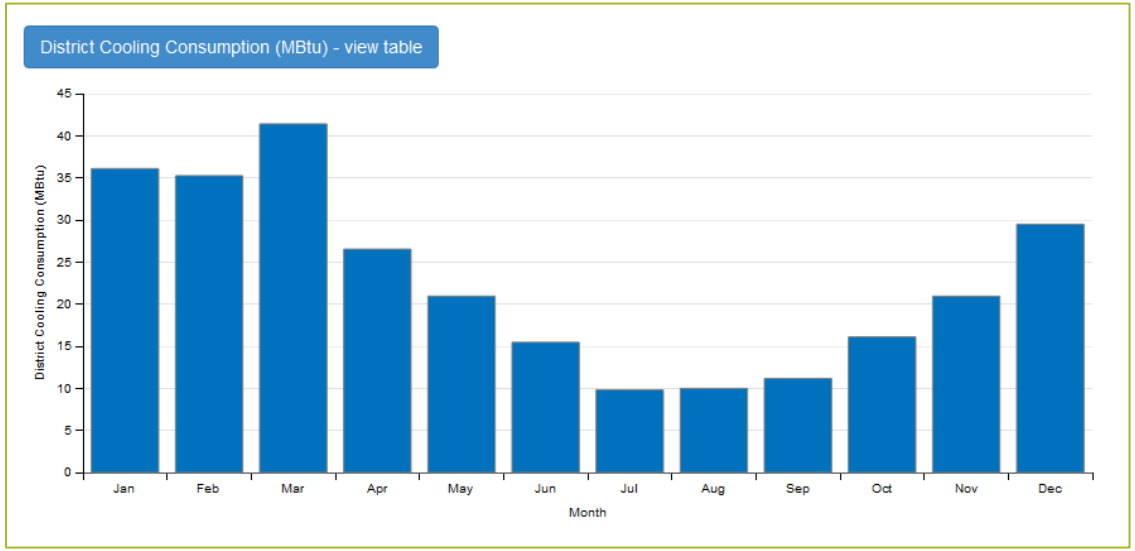


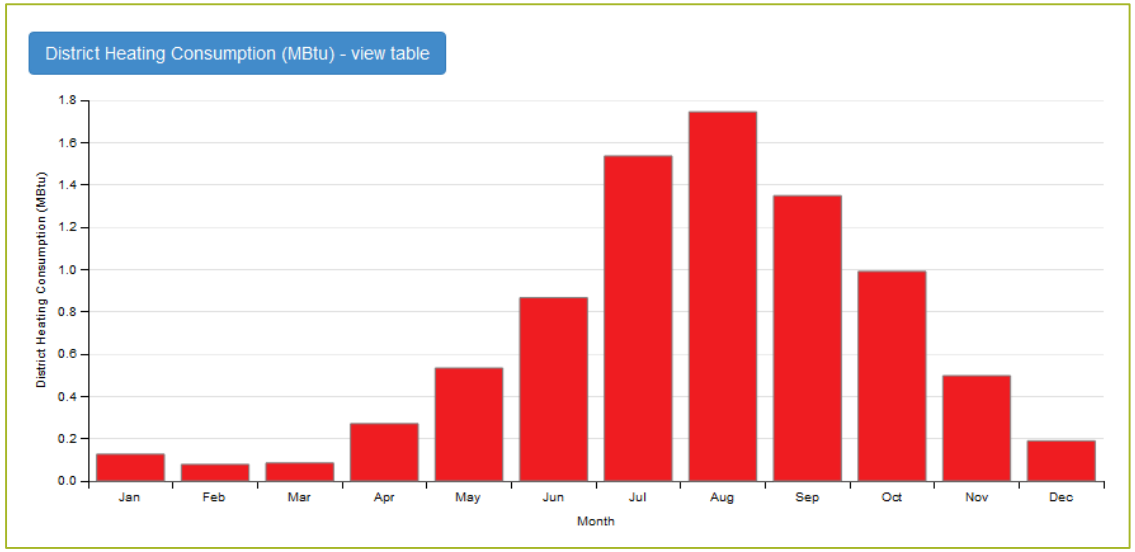


- If the clear glazing is changed by a theoretical glass [202], it can be seen that the Cooling consumption slightly increases from april up to december, due to the fact that the U-Factor is lower.
- The reduce for heating consumption is more significant than that of cooling.

LIMA: District Consumption – GLASS CASE 3

- The use of theoretical glass [221] shows that Cooling consumption significantly increases, this can be noticed in the month of march, where the consumption is 7 MBTU more than in the base case. Due to the fact that the U-Factor is lower.
- The heating consumption also reduces considerably. About 2 MBTU in August, the coldest month.





CONCLUSIONS

- It can be understood that the demand on heating and cooling loads is different on each site. Heating loads are greater in colder places as Stockholm & La Paz. Whereas, cooling loads are considerable in warmer and more humid cities as Lima.
- The heating and cooling consumption vary with modifying the wall materials. Likewise, changing the glazzing has an effect on the loads of the commercial building.
- It is necessary to consider the cost of energy consumption when deciding the materials to be used in the building. If using more expensive materials means that in the longterm one will save up costs of high energy consumption, then it is worth it to make the initial investement.