Politecnico di Milano – Sede di Piacenza

Technical Environmental Systems

A case study on the environmental impacts of a small-sized office space

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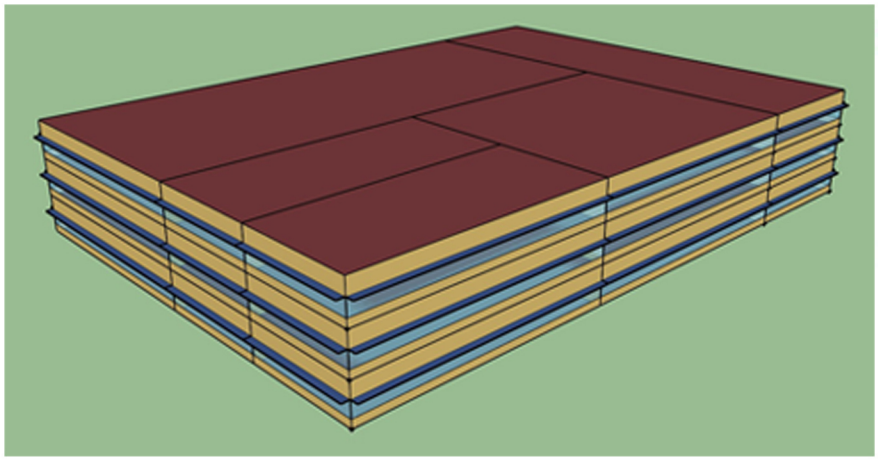
Inroduction

This project aims to study the environmental impacts of a small-sized office space in Piacenza, Quebec and Bandarabas. The research is divided into three different cities in order to measure the different outcomes in comparison to one another.

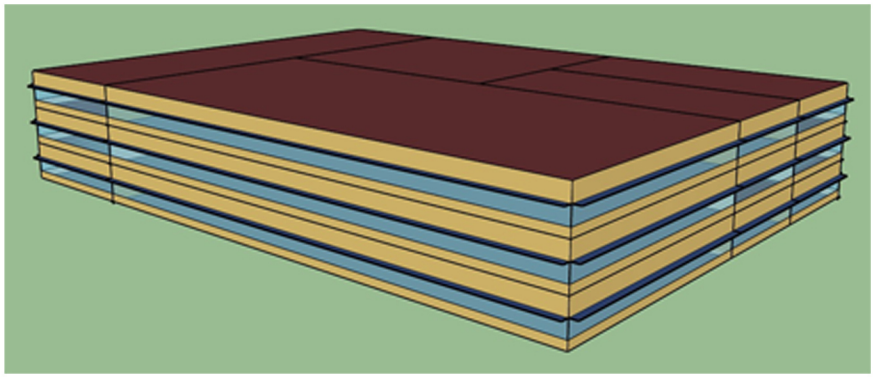
First Case Study: Piacenza

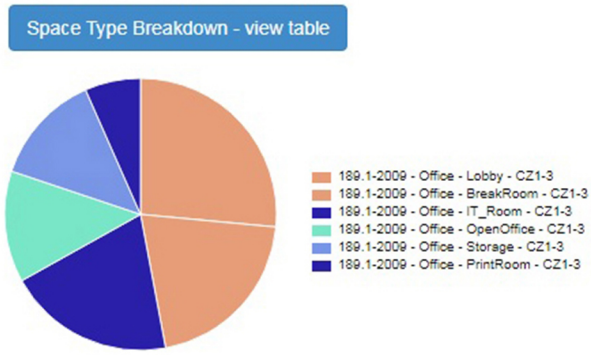


Building Area

	Area [m2]
Total Building Area	7670.49
Net Conditioned Building Area	7670.49
Unconditioned Building Area	0.00

Space Type Breakdown





Site and Source Energy

Type: Weak Insulation	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Total Energy [J]
Net Site Energy	4355.29	567.80	$4355.29*10^3$
Total Source Energy	12419.12	1619.08	$12419.12*10^3$

Type: Normal Insulation	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Total Energy [J]
Net Site Energy	4068.04	530.35	$4068.04*10^3$
Total Source Energy	11488.33	1497.73	$11488.33*10^3$

Type: Strong Insulation	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Total Energy [J]
Net Site Energy	3968.67	517.39	$3968.67*10^3$
Total Source Energy	11162.24	1455.22	$11162.24*10^3$

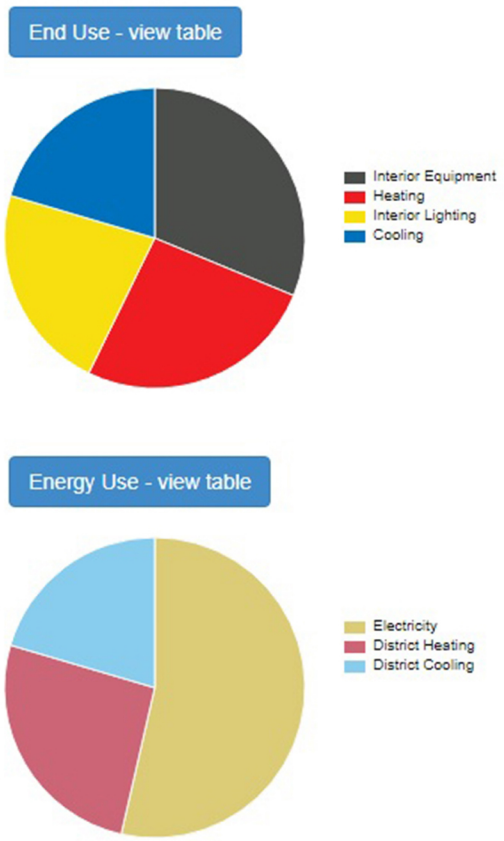


Figure 1 End Use Pie Graph
Weak Insulation

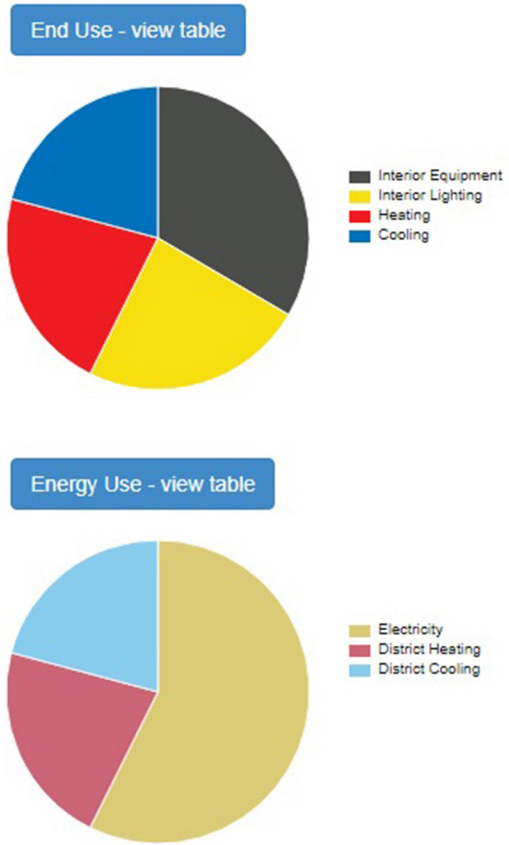


Figure 2 End Use Pie Graph
Normal Insulation

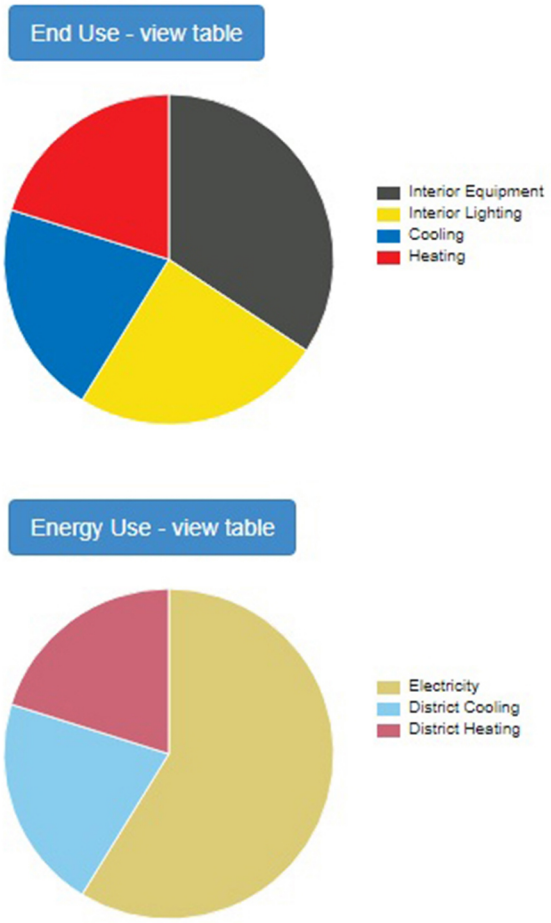


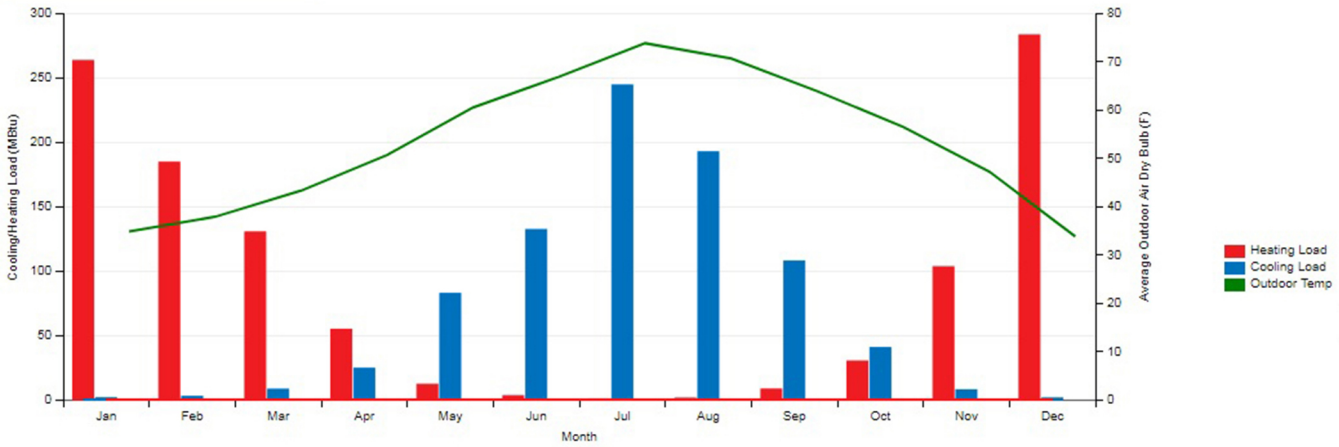
Figure 3 End Use Pie Graph
Strong Insulation

The first study which was applied in this research took place in the city of Piacenza. As seen in Figure 2, the End Use pie graph provided shows that while almost 21.78% of the system's energy use is dedicated to the heating of the system, almost 20.85% of the system's energy use is dedicated to the cooling of the system. Furthermore, the remaining 57% is divided between Interior Lighting and Interior Equipment.

HVAC Load Profiles

Monthly Load Profiles - view table

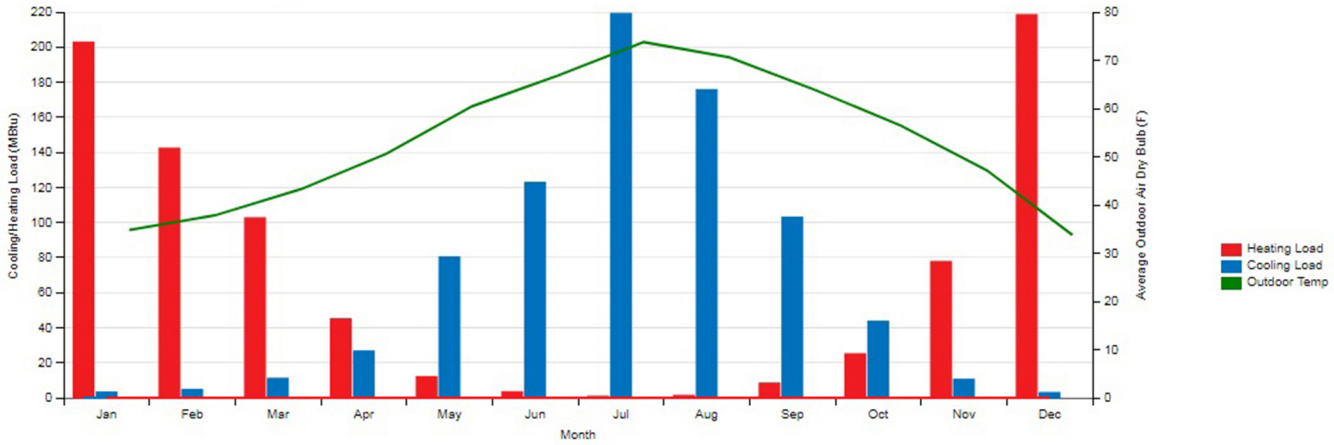
Type: Weak Insulation



HVAC Load Profiles

Monthly Load Profiles - view table

Type: Normal Insulation



HVAC Load Profiles

Monthly Load Profiles - view table

Type: Strong Insulation

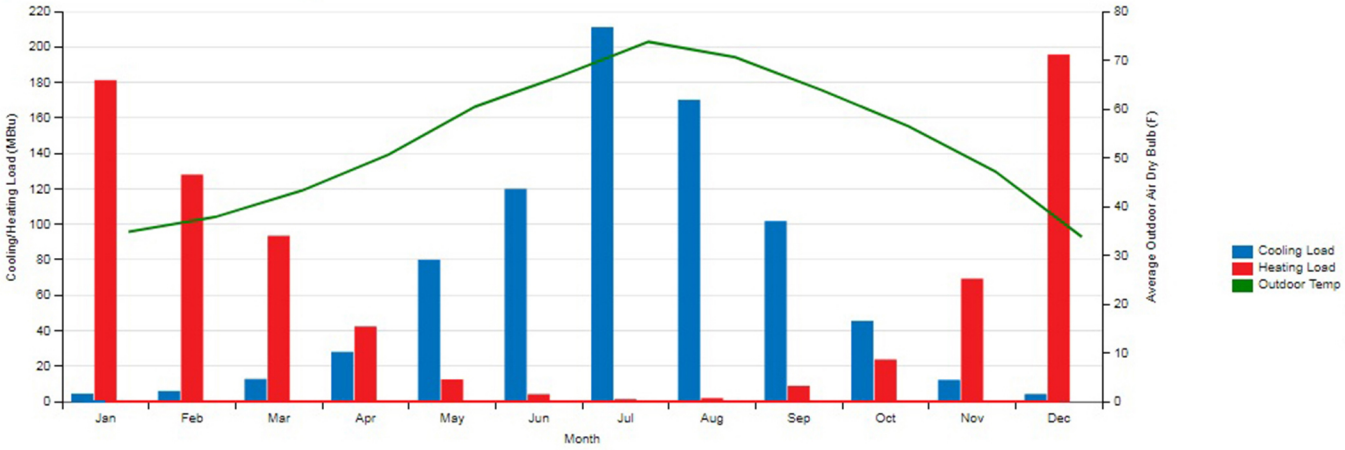


Table 1.1-Energy Use Summary(Normal Insulation)

	Process Subtotal [GJ]	Total Energy Use [GJ]
Electricity	1360.97	2333.75
Natural Gas	0.00	0.00
Additional	0.00	1734.29
Total	1360.97	4068.04

EAp2-18. End Use Percentage

Table1.2

	Percent [%]
Interior Lighting	23.91
Space Heating	21.78
Space Cooling	20.85
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	33.46
Miscellaneous	-0.00

Type: Normal Insulation

in order to further solidify the data gathered in the previously discussed graphs Table 1.1 and Table 1.2 provide us with information such as the end use summary for the energy used at the space at hand as well as the distribution of the energy used at the space throughout the year.

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	24.51
Space Heating	20.15
Space Cooling	21.05
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	34.29
Miscellaneous	-0.00

Type: Strong Insulation

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	22.34
Space Heating	25.98
Space Cooling	20.44
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	31.25
Miscellaneous	-0.00

Type: Weak Insulation

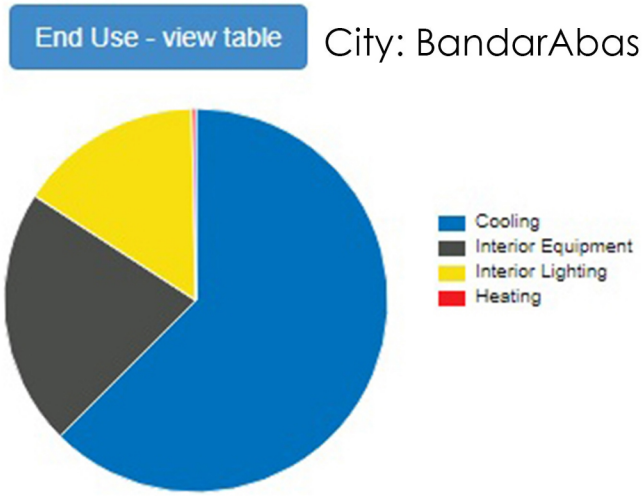
Table 2.1

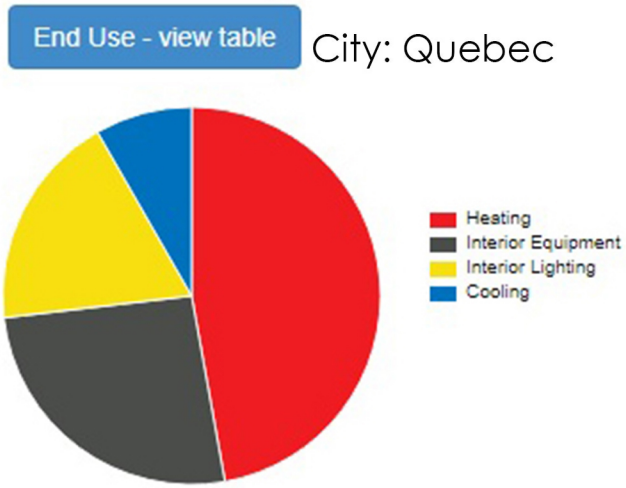
City: BandarAbas	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Total Energy [J]
Net Site Energy	6278.35	818.51	$6278.35*10^3$
Total Source Energy	11608.49	1513.40	$11608.49*10^3$

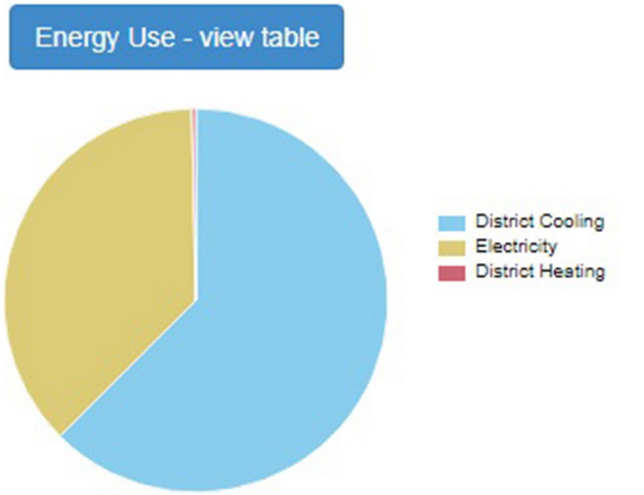
Table 2.2

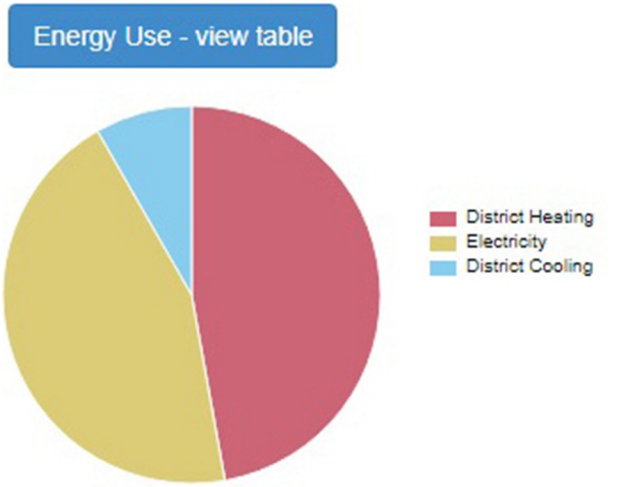
City: Quebec	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Total Energy [J]
Net Site Energy	5239.48	683.07	$5239.48*10^3$
Total Source Energy	16779.77	2187.57	$16779.77*10^3$

The second case study that took place in this research was made onto the same sized office space; however, in this study, the location of the system was changed from Piacenza, Italy to BandaAbas, Iran, and the third case study took place in Quebec, Canada. As Shown in table2.1 and table2.2, the second and third case study yielded totally different results in terms of the System's End Use and Electrical Use









Conclusion

In general, the three case studies resulted in very interesting outcomes that can be considered really valuable in understanding the different environmental systems of different cities or regions. we can see that different variables result in different outcomes in the system's environmental performance.
Forexample, the first case study proved that the changing of the materials is also considered when studying the performance of a system as it may have an impact which may result in different outcomes and results. Furthermore,as seen in the second and third case studies the changing of the location can have a huge impact on the system's energy performance.

Thank you.