

TECHNICAL ENVIRONMENTAL SYSTEMS

FALL 2017 FINAL ASSIGNMENT

Prof. Renzo MARCHESI

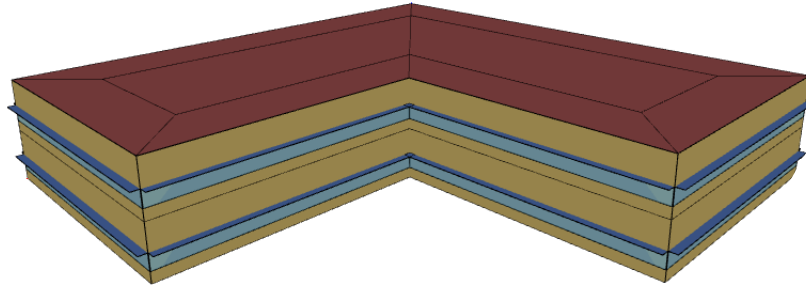
Adjunct Prof. Behzad Najafi

EGE DÖŞEMECİ

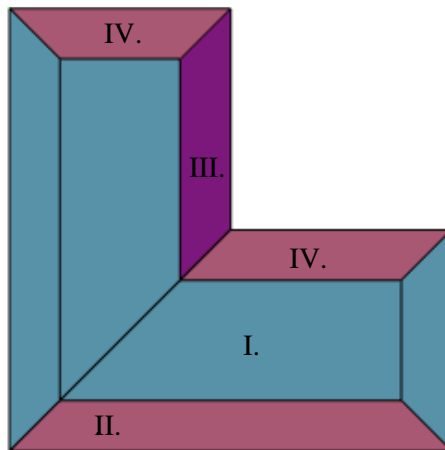
ASYA BERFU ATALAY

I. Introduction

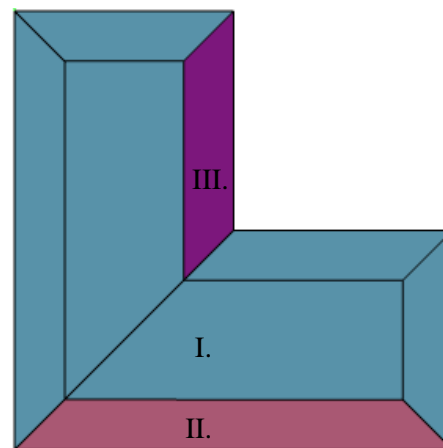
The office building consists of two storeys, different kinds of spaces and 6 thermal zones. On the first floor, there is (I) closed & open office, (II) one breakroom, (III) a restroom and (IV) two stairs. And the second floor consists of (I) closed & open offices, (II) a breakroom and (III) a restroom.



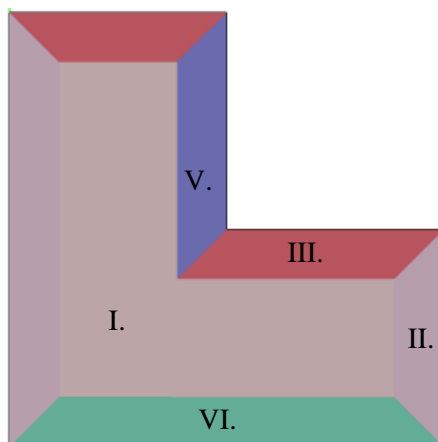
1st floor :



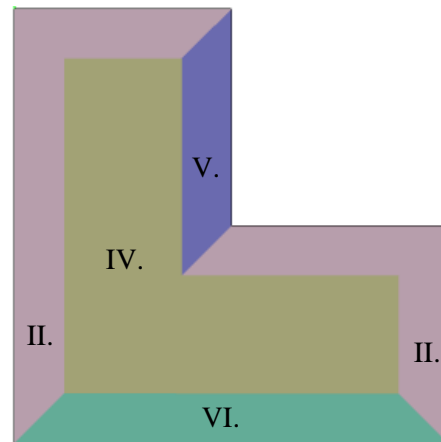
2nd floor:



Thermal Zones:



Thermal Zone 1: Open Office
Thermal Zone 2: Closed Office
Thermal Zone 3: Stairs



Thermal Zone 4: Open Office
Thermal Zone 5: Restrooms
Thermal Zone 6: Breakroom

II. Cases

A. Different Locations

WALL TYPE 3 : *G05 25 mm Wood, M11 100mm Lightweight Concrete, Wall Insulation, G01a 19mm Gypsum Board, G01a 19mm Gypsum Board*

1. ISTANBUL

In the first scenario, the office building is located in Istanbul and the total energy consumption is observed while the external wall layers are the same.

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	1534.97	639.57	639.57
Net Site Energy	1534.97	639.57	639.57
Total Source Energy	4306.83	1794.51	1794.51
Net Source Energy	4306.83	1794.51	1794.51

END USES

Heating (District Heating) [GJ]	412.74
Cooling (District Cooling) [GJ]	349.84

2. BERLIN

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	1675.01	697.2	697.2
Net Site Energy	1675.01	697.2	697.2
Total Source Energy	5303.65	2209.86	2209.86
Net Source Energy	5303.65	2209.86	2209.86

END USES

Heating (District Heating) [GJ]	744.67
Cooling (District Cooling) [GJ]	157.95

3. CAPE TOWN

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	1283.96	534.98	534.98
Net Site Energy	1283.96	534.98	534.98
Total Source Energy	3385.59	1410.66	1410.66
Net Source Energy	337	1410.66	1410.66

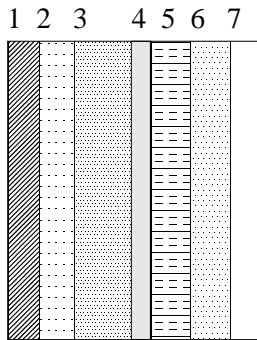
END USES

Heating (District Heating) [GJ]	156.15
Cooling (District Cooling) [GJ]	355.42

B. Different wall layers

LOCATION: ISTANBUL

• TYPE 1



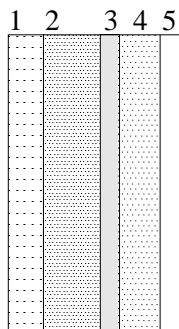
1. Metal Decking
2. 1IN Stucco
3. 8IN Concrete HW
4. I01 25mm Insulation Board
5. F04 Wall Air Space Resistance
6. M11 100mm Lightweight Concrete
7. ½ IN Stucco

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	1542.11	642.55	642.55
Net Site Energy	1542.11	642.55	642.55
Total Source Energy	4333.56	1805.65	1805.65
Net Source Energy	4333.56	1805.65	1805.65

END USES

Heating (District Heating) [GJ]	420.24
Cooling (District Cooling) [GJ]	349.49

• TYPE 2



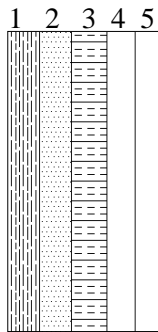
1. 1IN Stucco
2. 8IN Concrete HW
3. I01 25mm Insulation Board
4. M11 100mm Lightweight Concrete
5. ½ IN Stucco

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	1551.03	646.26	646.26
Net Site Energy	1551.03	646.26	646.26
Total Source Energy	4338.37	1807.66	1807.66
Net Source Energy	4338.37	1807.66	1807.66

END USES

Heating (District Heating) [GJ]	418.44
Cooling (District Cooling) [GJ]	360.21

• TYPE 3



1. G05 25 mm Wood
2. M11 100mm Lightweight Concrete
3. Wall Insulation
4. G01a 19mm Gypsum Board
5. G01a 19mm Gypsum Board

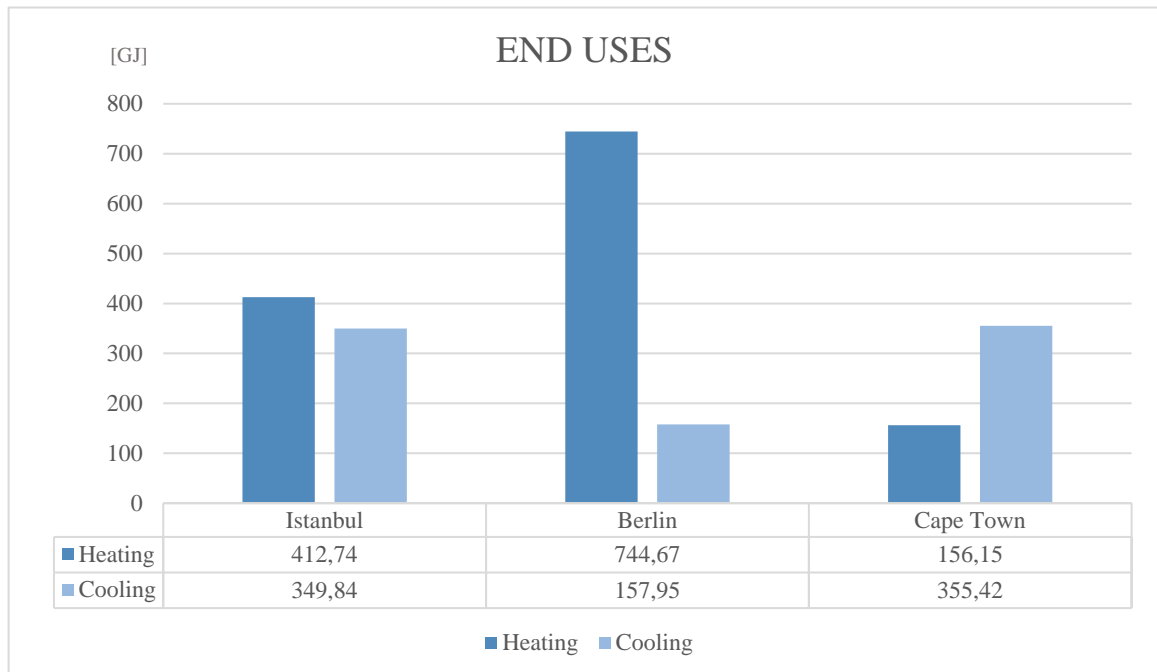
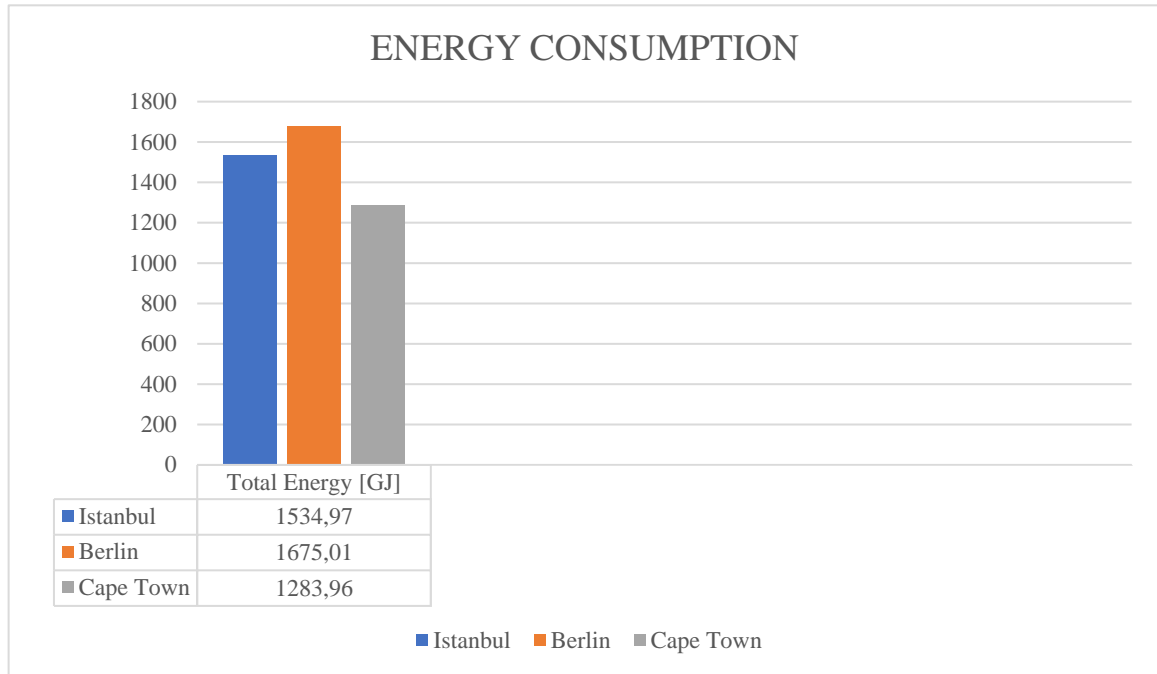
	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	1534.97	639.57	639.57
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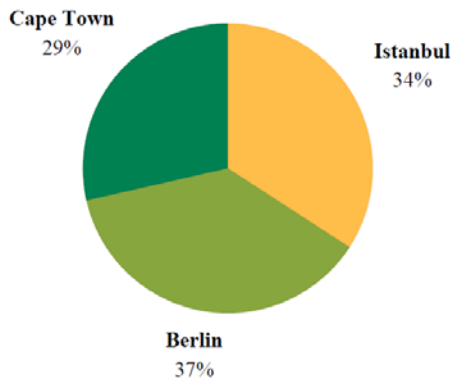
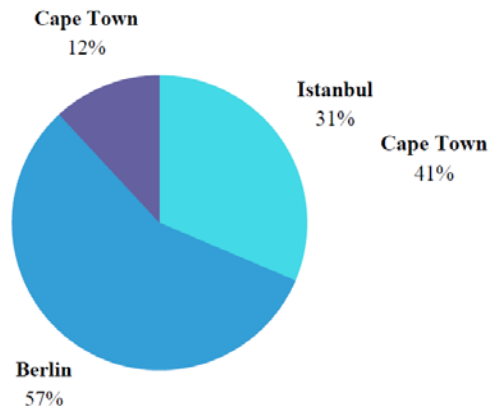
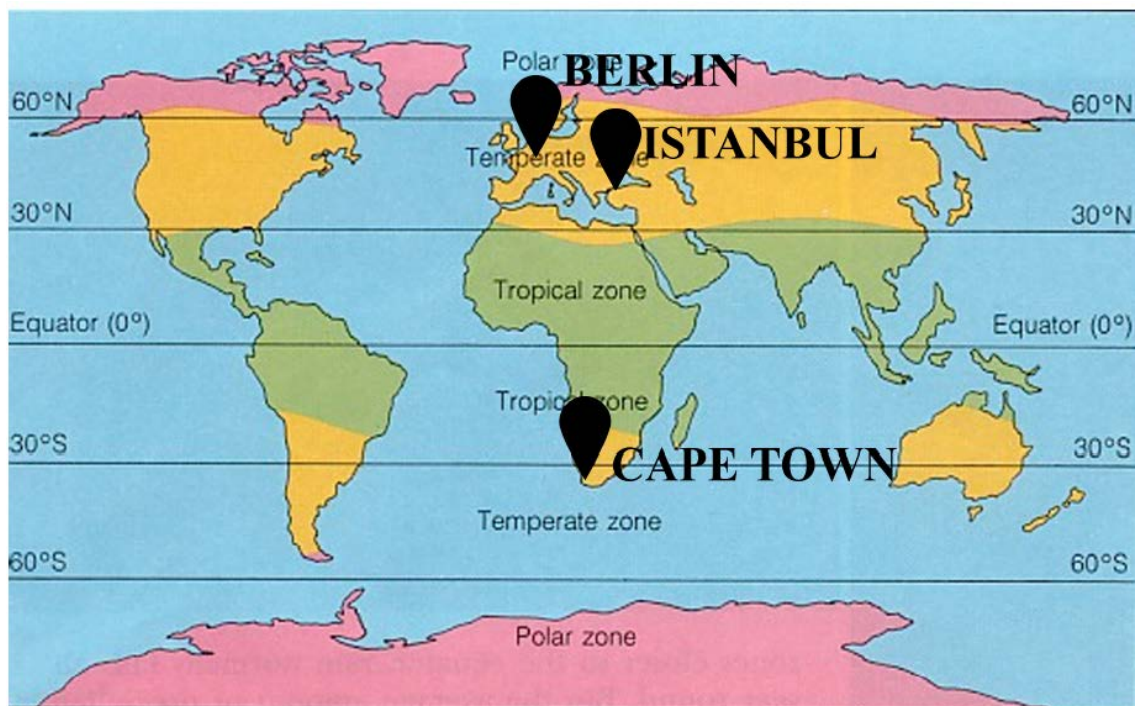
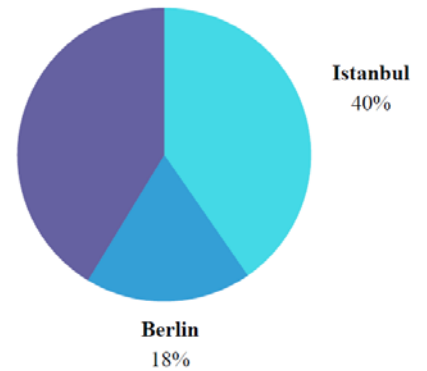
END USES

Heating (District Heating) [GJ]	412.74
Cooling (District Cooling) [GJ]	349.84

III. Conclusion

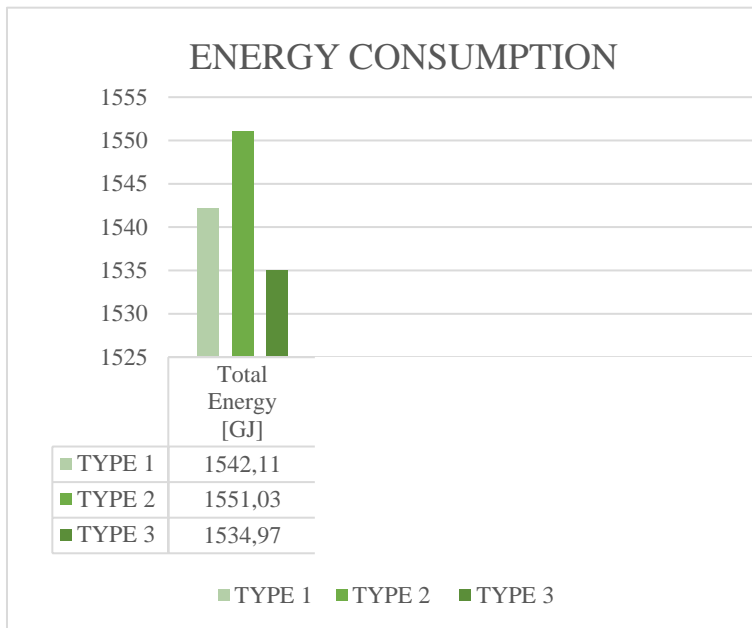
A. DIFFERENT LOCATIONS



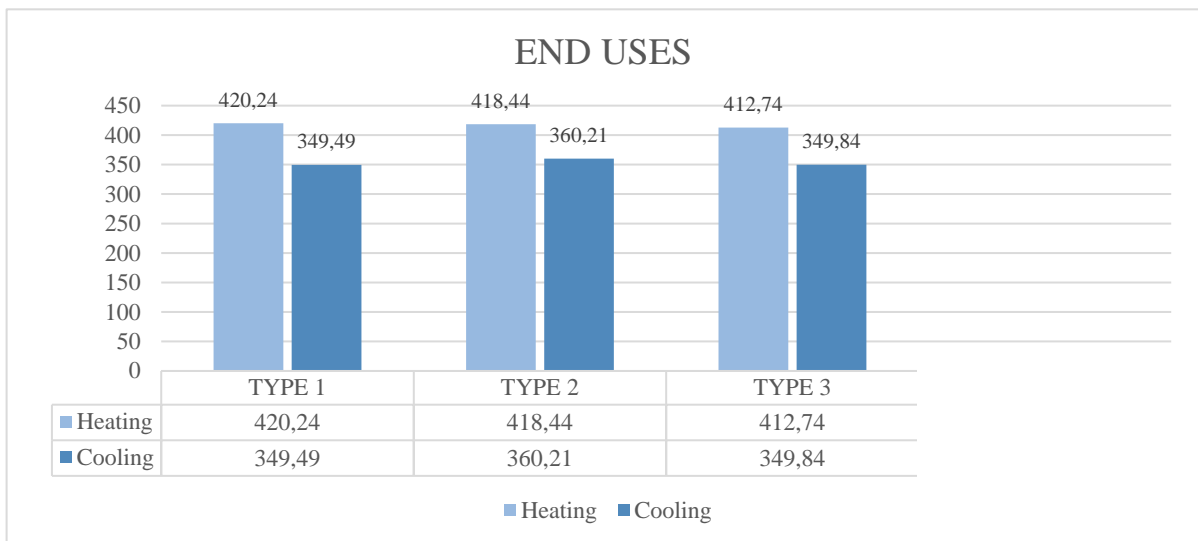
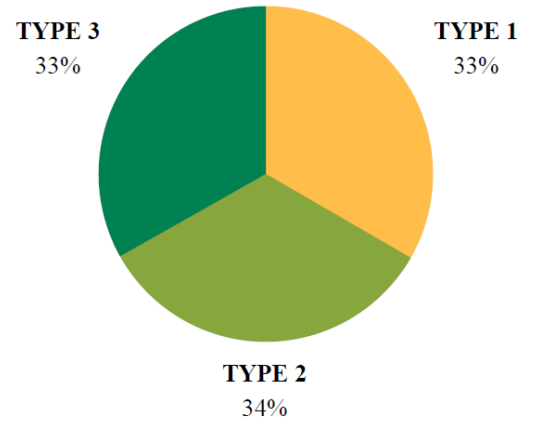
ENERGY CONSUMPTION (%)**END USES: HEATING (%)****END USES:****COOLING (%)**

Energy consumptions and annual end uses for heating and cooling differ a lot in these three locations. Cape town is the nearest to the tropical zone, while Istanbul the second nearest and Berlin the last. As seen from the results, Berlin uses max energy for heating while cape town uses it for cooling. This is due to their climates/climate zones. If the building is located in Berlin, it will consume much more energy than two other cities. According to the data, the building in Cape Town can be considered as the most efficient and sustainable one in terms of energy consumption.

B. WALL TYPES



ENERGY CONSUMPTION %



In order to compare energy consumptions of the same building when different wall types are used, Istanbul is chosen as the location. Among the 3 types of walls, Type 2 consumes the most energy while Type 3 consumes the least. Heating consumptions are higher than cooling in all 3 cases.

Type 1 is different than Type 2 in two layers; there is an extra air layer between two concrete layers for increasing insulation, and there is metal decking for the outer surface. Although Type 1 is less energy consuming than Type 2 because of these additions, the difference is not considerable. In Type 3, instead of using 100mm lightweight concrete for inner wall as done in Type 1 and 2, two layers of 19mm gypsum board is used. Although it resulted with the least energy consumption, the difference is again not significant.