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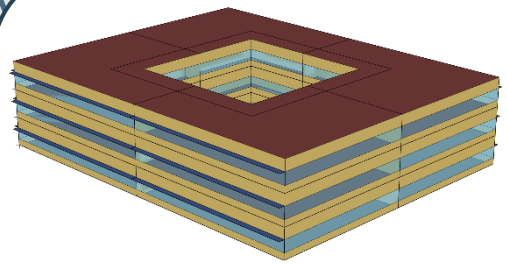
TECHNICAL ENVIRONMENTAL SYSTEMS PROJECT PRESENTATION

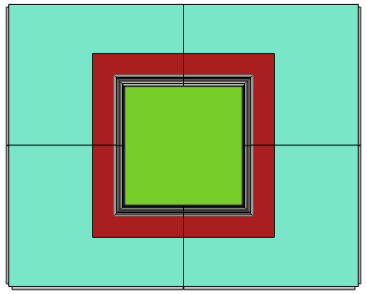
PROF. BEHZAD NAJAFI

GROUP MEMBERS :
ALMUHANAD ALAMERI, KARDELEN KAZAN, DEMRE ERTEM, SEZIN TUTUNCUOGLU

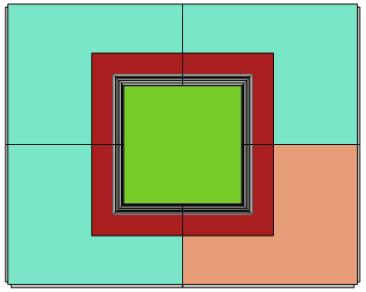
THE GEOMETRY AND CHARACTERISTICS OF THE BUILDING



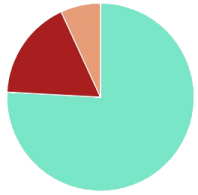
TYPICAL FLOOR



ENTRANCE FLOOR



OPEN OFFICE
CORRIDOR
LOBBY
COURTYARD

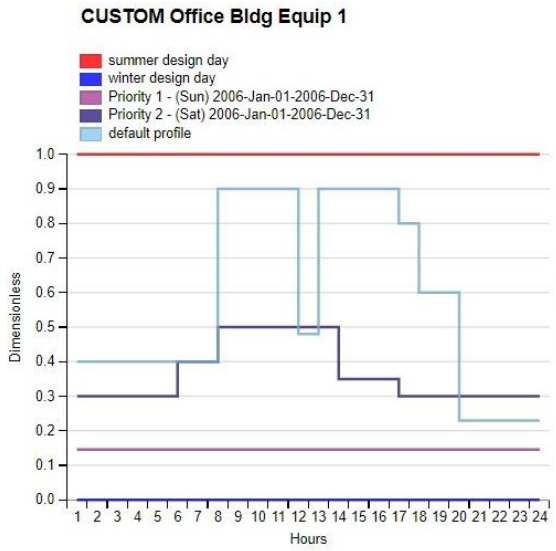


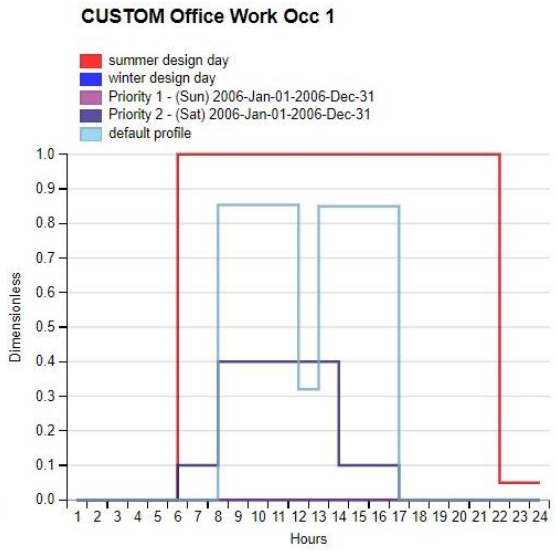
Building Summary

Data	Value
Building Name	Building 1
Total Site Energy	3,011,689 kBtu
Total Building Area	51,667 ft^2
Total Site EUI	58.29 kBtu/ft^2
OpenStudio Standards Building Type	n/a

Space Type Name	Floor Area (ft^2)	Standards Building Type	Standards Space Type
189.1-2009 - Office - Corridor - CZ1-3	8,913	Office	Corridor
189.1-2009 - Office - Lobby - CZ1-3	3,563	Office	Lobby
189.1-2009 - Office - OpenOffice - CZ1-3	39,191	Office	OpenOffice

- 40 x 50 meter rectangle shape
- 4 m height 3 levels
- 4 rooms in each level
- 10x 10 m courtyard in the center
- 3 m width corridor at around the courtyard
- There is canopy at all facades excepts for north facade and courtyard facades.





WEATHER INFORMATION OF THE CHOSEN CITIES

ISTANBUL / Turkey

Istanbul has a borderline Mediterranean climate, humid subtropical climate, and oceanic climate, due to its location in a transitional climatic zone.
The average high and low temperatures ever recorded in the city center on the Marmara coast are 26.5 °C and 3°C.

Weather Summary

	Value
Weather File	ISTANBUL - TUR IWEC Data WMO#=170600
Latitude	40.97
Longitude	28.82
Elevation	121 ft
Time Zone	2.00
North Axis Angle	0.00
ASHRAE Climate Zone	

COPENHAGEN / Denmark

Copenhagen is in the oceanic climate zone. Its weather is subject to low - pressure systems from the Atlantic which result in unstable conditions throughout the year.
The average high and low temperatures ever recorded in Copenhagen are 22.2 °C and 0°C.

Weather Summary

	Value
Weather File	COPENHAGEN - DNK IWEC Data WMO#=061800
Latitude	55.63
Longitude	12.67
Elevation	16 ft
Time Zone	1.00
North Axis Angle	0.00
ASHRAE Climate Zone	

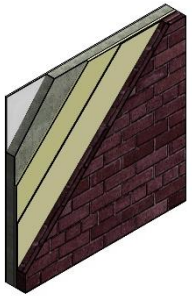
ABU DHABI / United Arab Emirates

Abu Dhabi has a hot desert climate. On average, January is the coolest month in the year, while August is the hottest.
The average high and low temperatures ever recorded in the city are 42.9 °C and 13.2 °C.

Weather Summary

	Value
Weather File	ABU DHABI - ARE IWEC Data WMO#=412170
Latitude	24.43
Longitude	54.65
Elevation	89 ft
Time Zone	4.00
North Axis Angle	0.00
ASHRAE Climate Zone	

THE LAYERS AND THE CALCULATED U VALUES OF THE CONSİDERED EXTERNAL WALLS

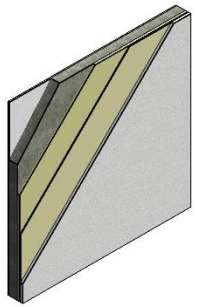


R-Value = 0.075+0.16+0.7+0.27+0.079 = 1.284 $m^2\,^oC/W$

U-Factor = $\frac{1}{1.284}$ = 0.78 W / $m^2\,^oC$

WALL TYPE I

	NAME OF THE MATERIALS	THICKNESS mm	R – VALUE $m^2.^oC/W$	U–FAC-TOR W / $m^2\,^oC$
1	FACE BRICK	100	0.075	-
2	WALL AIR SPACE	13	0.16	-
3	GLASS FIBER	25	0.7	-
4	CONCRETE	254	0.27	-
5	GYPSUM	13	0.079	-
TOTAL		405	1.284	0.78

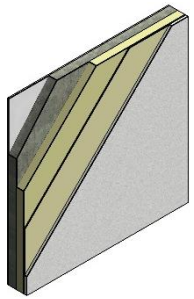


R-Value = 0.037+0.16+0.7+0.27+0.079 = 1.246 $m^2\,^oC/W$

U-Factor = $\frac{1}{1.246}$ = 0.80 W / $m^2\,^oC$

WALL TYPE II

	NAME OF THE MATERIALS	THICKNESS mm	R – VALUE $m^2.^oC/W$	U – FACTOR W / $m^2\,^oC$
1	STUCCO	25	0.037	-
2	WALL AIR SPACE	13	0.16	-
3	GLASS FIBER	25	0.7	-
4	CONCRETE	254	0.27	-
5	GYPSUM	13	0.079	-
TOTAL		330	1.246	0.80



R-Value = 0.037+0.16+1.77+0.27+0.079 = 2.316 $m^2\,^oC/W$

U-Factor = $\frac{1}{2.316}$ = 0.43 W / $m^2\,^oC$

WALL TYPE III

	NAME OF THE MATERIALS	THICKNESS mm	R – VALUE $m^2.^oC/W$	U – FACTOR W / $m^2\,^oC$
1	STUCCO	25	0.037	-
2	WALL AIR SPACE	13	0.16	-
3	MINERAL FIBER	89	1.77	-
4	CONCRETE	254	0.27	-
5	GYPSUM	13	0.079	-
TOTAL		394	2.316	0.43

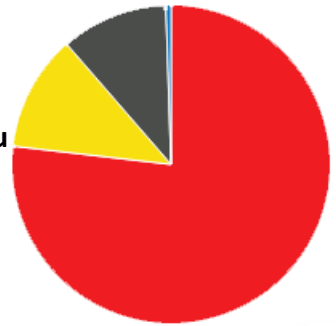
	NAMEOF THE MATERIAL	WALL I		WALL II		WALL III	
		THICKNESS *mm*	R – VALUE *$m^2.^oC/W$*	THICKNESS *mm*	R – VALUE *$m^2.^oC/W$*	THICKNESS *mm*	R – VALUE *$m^2.^oC/W$*
1	FACE BRICK	100	0.075	-	-	-	-
1	STUCCO	-	-	25	0.037	25	0.037
2	WALL AIR SPACE	13	0.16	13	0.16	13	0.16
3	GLASS FIBER	25	0.7	25	0.7	-	-
3	MINERAL FIBER	-	-	-	-	89	1.77
4	CONCRETE	254	0.27	254	0.27	254	0.27
5	GYPSUM	13	0.079	13	0.079	13	0.079
TOTAL		405	1.284	330	1.246	394	2.316

THE MONTHLY HEATING AND COOLING CONSUMPTİON FOR THE BASE CASE – **COPENHAGEN** –

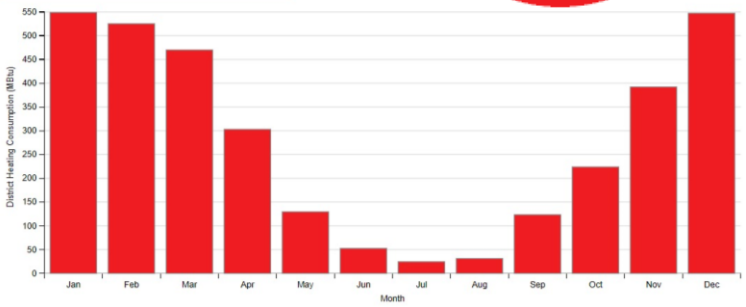
WALL 1

OPEN STUDIO RESULTS

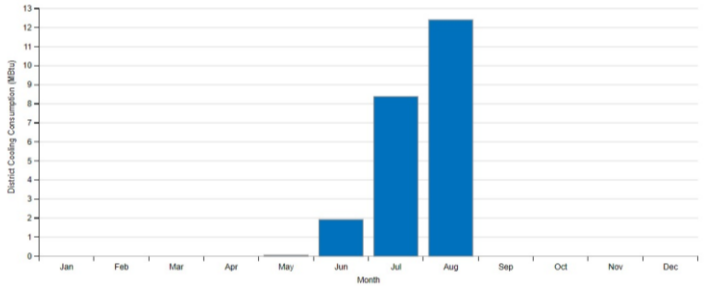
- **HEATING : 3.370.798 kBtu**
- INTERIOR LIGHTING : 516.996
- INTERIOR EQUIPMENT : 476.799
- **COOLING : 22.748 kBtu**



District Heating Consumption (MBtu) - view table



District Cooling Consumption (MBtu) - view table



ENERGY PLUS RESULTS

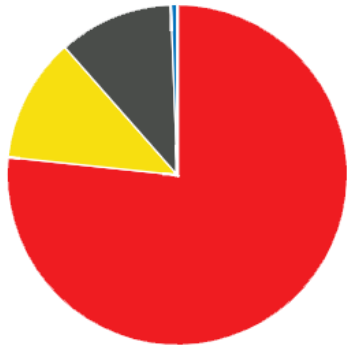
End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	3556.38	0.00
Cooling	0.00	0.00	0.00	24.00	0.00	0.00

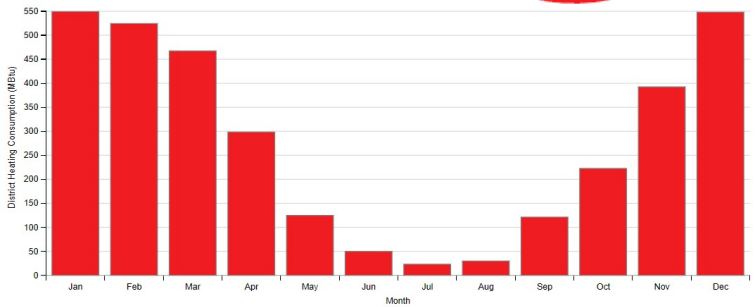
WALL 2

OPEN STUDIO RESULTS

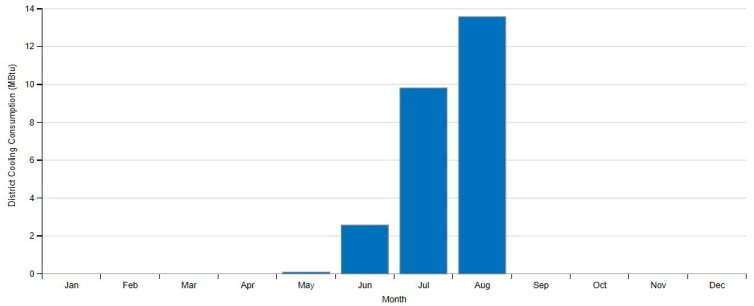
- **HEATING : 3.351.728 kBtu**
- INTERIOR LIGHTING : 516.996
- INTERIOR EQUIPMENT : 476.799
- **COOLING : 26.046 kBtu**



District Heating Consumption (MBtu) - view table



District Cooling Consumption (MBtu) - view table



ENERGY PLUS RESULTS

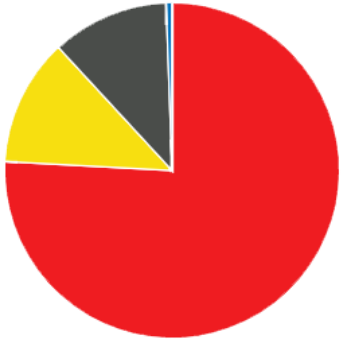
End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	3536.26	0.00
Cooling	0.00	0.00	0.00	27.48	0.00	0.00

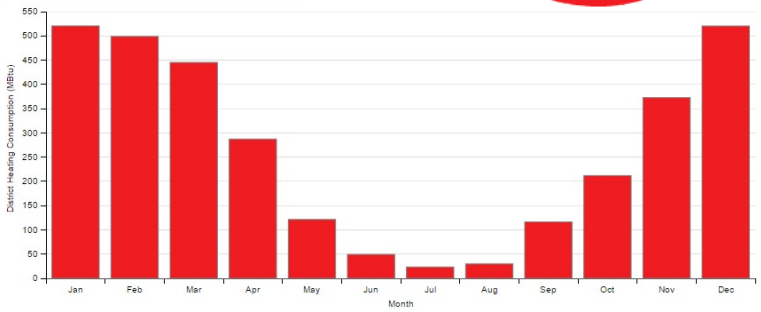
WALL 3

OPEN STUDIO RESULTS

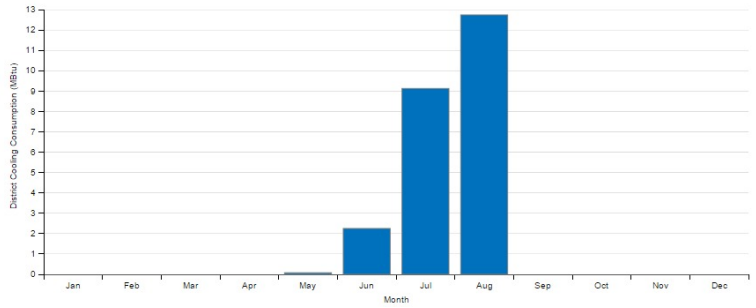
- **HEATING : 3.197.546 kBtu**
- INTERIOR LIGHTING : 516.996
- INTERIOR EQUIPMENT : 476.799
- **COOLING : 24.198 kBtu**



District Heating Consumption (MBtu) - view table



District Cooling Consumption (MBtu) - view table

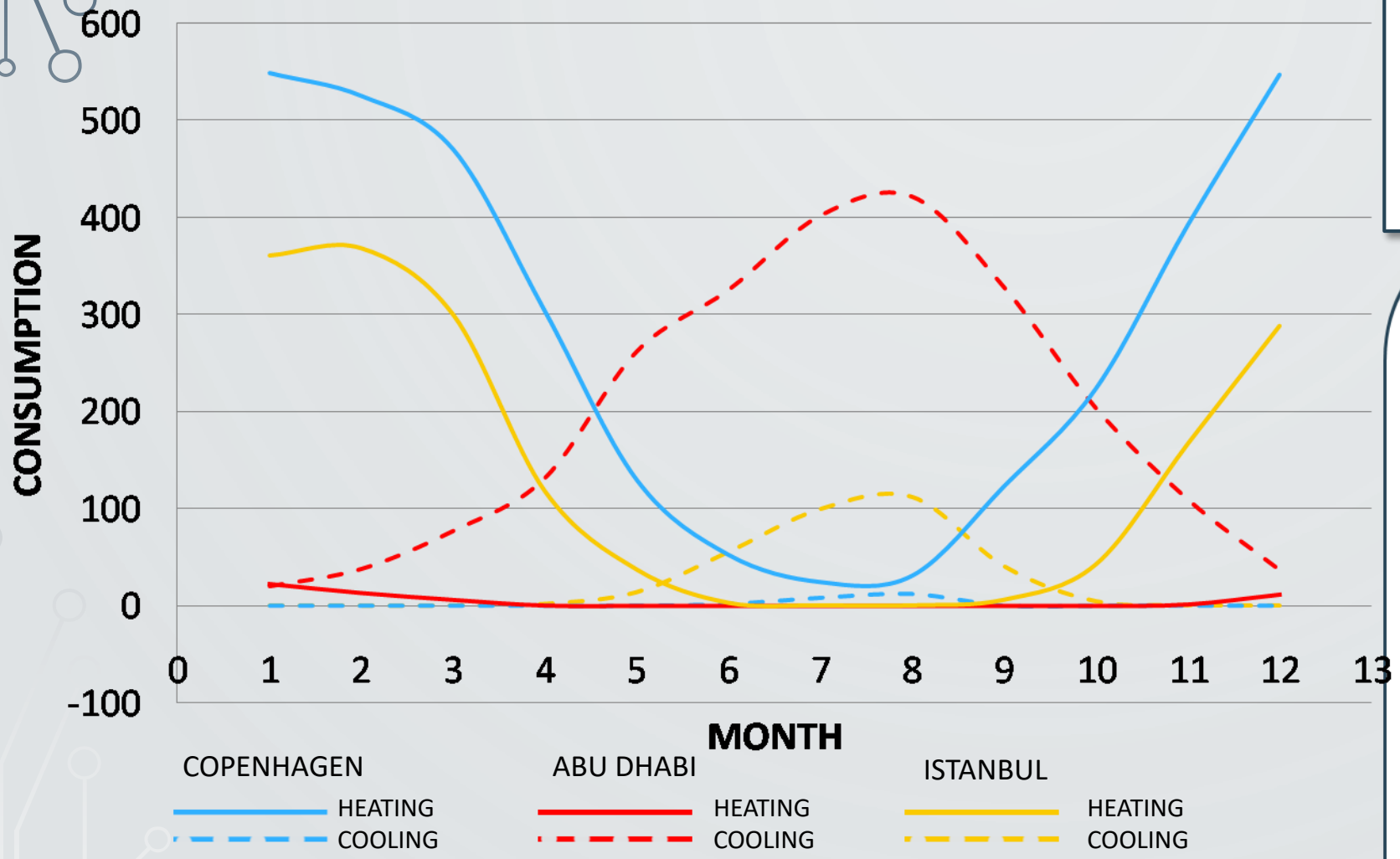


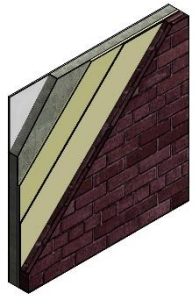
ENERGY PLUS RESULTS

End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	3373.59	0.00
Cooling	0.00	0.00	0.00	25.53	0.00	0.00

WALL TYPE 1 COMPARISON OF OVERALL YEARLY COOLİNG AND HEATİNG CONSUMPTİON FOR THE STUDİED CASES





WALL TYPE I

R-Value = 0.075+0.16+0.7+0.27+0.079 = 1.284 $m^2\,^oC/W$

U-Factor = $\frac{1}{1.284}$ = 0.78

ABU DHABI

End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	58.41	0.00
Cooling	0.00	0.00	0.00	2491.14	0.00	0.00

COPENHAGEN

End Uses

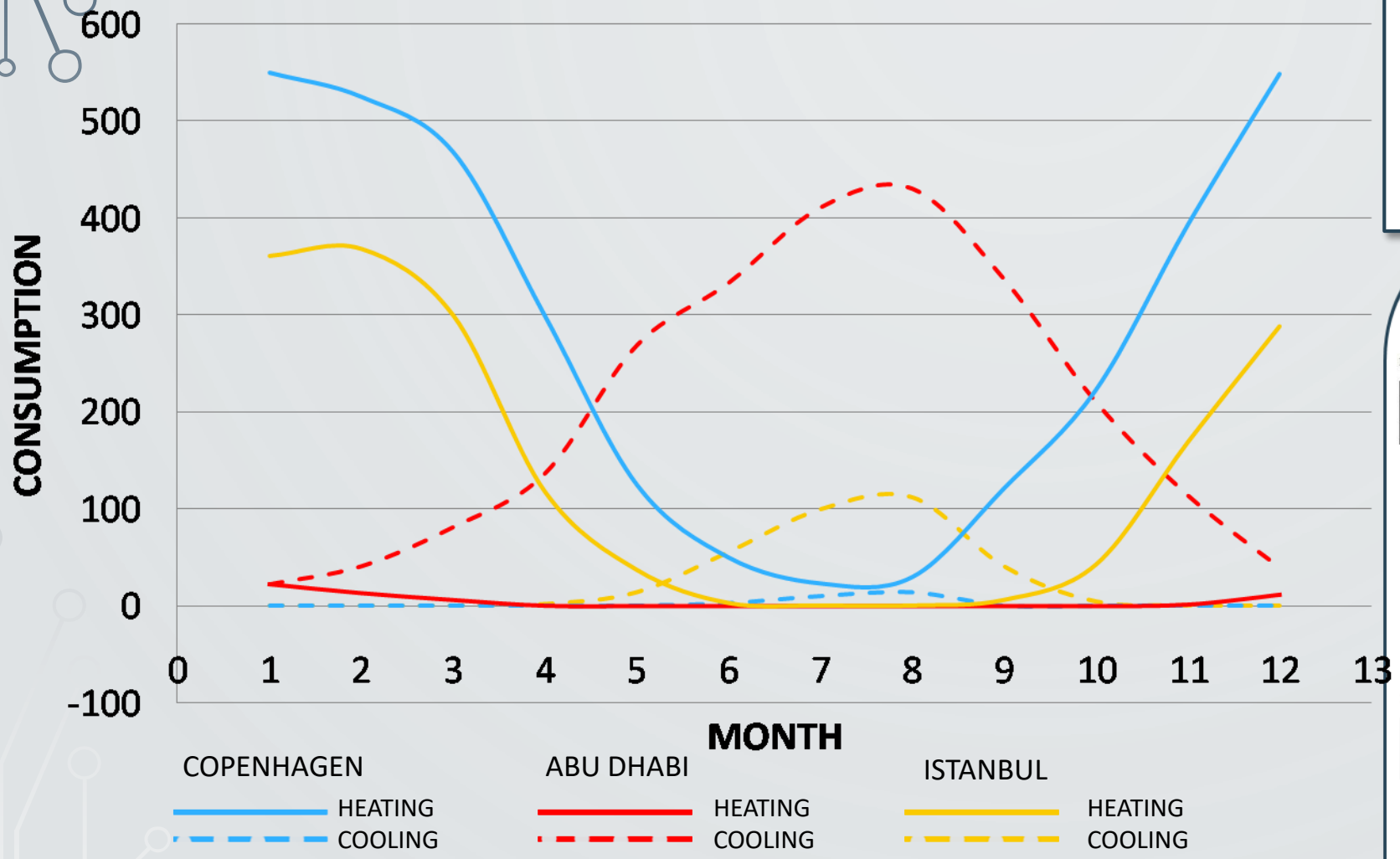
	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	3556.38	0.00
Cooling	0.00	0.00	0.00	24.00	0.00	0.00

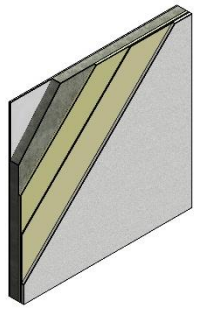
ISTANBUL

End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	1782.83	0.00
Cooling	0.00	0.00	0.00	346.16	0.00	0.00

WALL TYPE 2 COMPARISON OF OVERALL YEARLY COOLİNG AND HEATİNG CONSUMPTİON FOR THE STUDİED CASES





WALL TYPE II

R-Value = 0.037+0.16+0.7+0.27+0.079 = 1.246 $m^2\,^oC/W$

U-Factor = $\frac{1}{1.246}$ = 0.80

ABU DHABI

End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	58.05	0.00
Cooling	0.00	0.00	0.00	2552.32	0.00	0.00

COPENHAGEN

End Uses

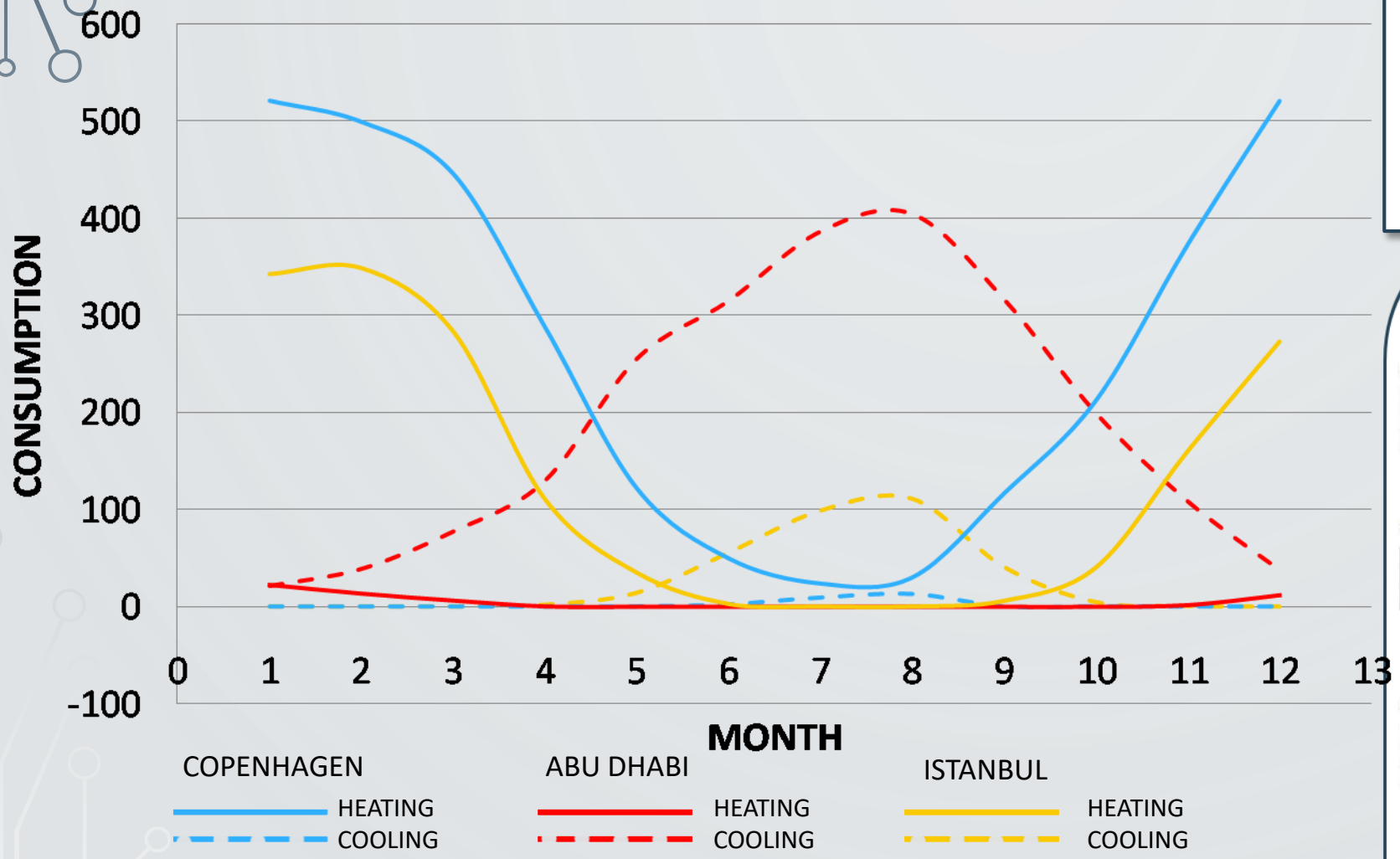
	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	3536.26	0.00
Cooling	0.00	0.00	0.00	27.48	0.00	0.00

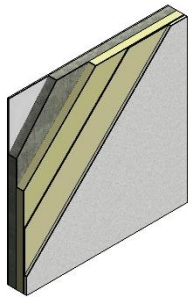
ISTANBUL

End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	1766.48	0.00
Cooling	0.00	0.00	0.00	362.87	0.00	0.00

WALL TYPE 3 COMPARISON OF OVERALL YEARLY COOLİNG AND HEATİNG CONSUMPTİON FOR THE STUDİED CASES





WALL TYPE III

R-Value = 0.037+0.16+1.77+0.27+0.079 = 2.316 $m^2\,^oC/W$

U-Factor = $\frac{1}{2.316}$ = 0.43

ABU DHABI

End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	59.94	0.00
Cooling	0.00	0.00	0.00	2412.16	0.00	0.00

COPENHAGEN

End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	3373.59	0.00
Cooling	0.00	0.00	0.00	25.53	0.00	0.00

ISTANBUL

End Uses

	Electricity [GJ]	Natural Gas [GJ]	Additional Fuel [GJ]	District Cooling [GJ]	District Heating [GJ]	Water [m3]
Heating	0.00	0.00	0.00	0.00	1782.83	0.00
Cooling	0.00	0.00	0.00	346.16	0.00	0.00

CONCLUSION:

- Buildings with walls with a higher R-Value perform better because they are less affected or more resistant to the outdoor temperature by slowing down the heat transfer as was shown in our base case example for Copenhagen with wall 3 getting the best results for annual heating consumption.

- Different wall, roof, and floor assemblies and thicknesses is applied to different climate zones to get the best performance out of the building, making them more sustainable by lowering the carbon footprint and costs produced by the building after its construction.

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MILANO 1863

THANK YOU !

PROF. BEHZAD NAJAFI

GROUP MEMBERS :
ALMUHANAD ALAMERI, KARDELEN KAZAN, DEMRE ERTEM, SEZIN TUTUNCUOGLU

Thats all Folks!