Assignment Report

Technical Environmental Systems

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Group Members

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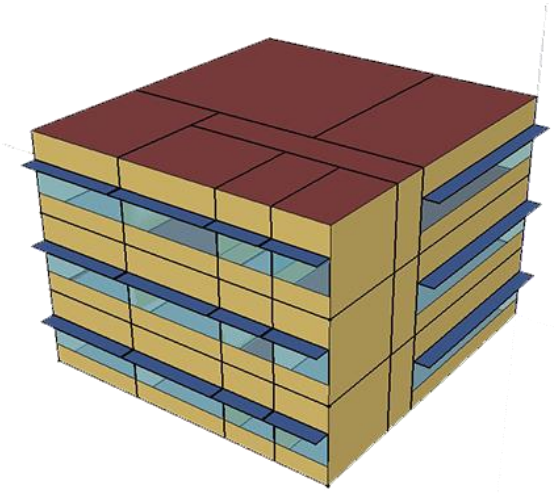
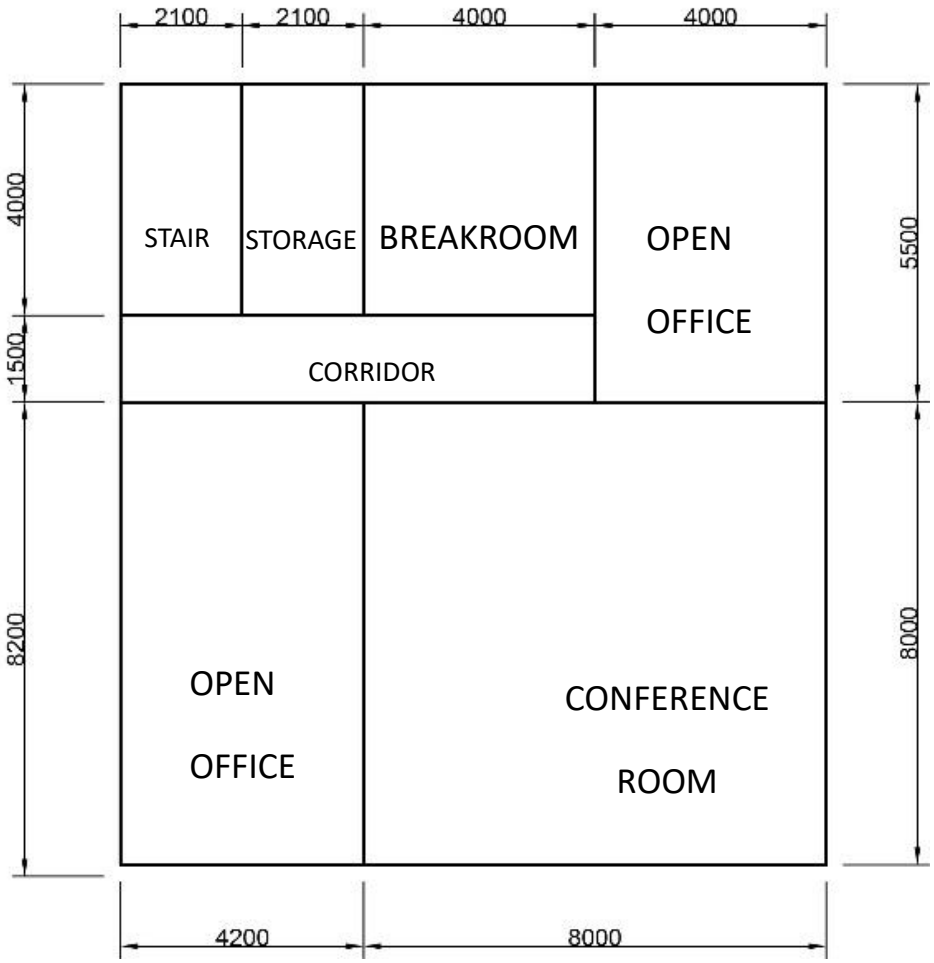
INTRODUCTION

In this report, we calculated the energy consumption of a 3-floor office building, with total area of 5318 sqm. It mainly consists of open offices、conference room、breakroom and storage room. For analyzing the influence of weather in energy consumption, we took three different cities with diverse weather data as our building environment, which are Milan, Berlin and Beijing. In addition, in order to know about the impact of buildings construction on energy use, we changed constructions of external walls to make further comparison. Here below is the building plan and information of the building we have chosen.

Building Type： Office
Area：5318 sqm
Floors: 3
Height: inches
Location 1: Milan
Location 2: Beijing
Location 3: Berlin





Unit conversation:
1 BTU = 0.00029307107017 kWh
1” = 25.4mm

Analysis 1 Milan Wall 1

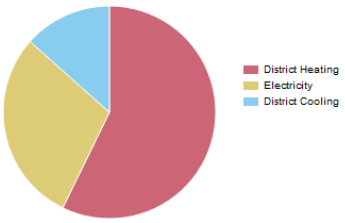
Weather Summary

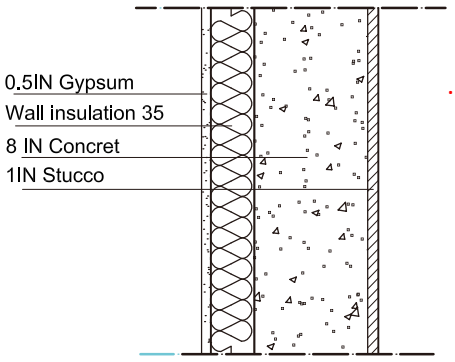
	Value
Weather File	MILAN - ITA IWEC Data WMO#=160660
Latitude	45.62
Longitude	8.73
Elevation	692 (ft)
Time Zone	1.00
North Axis Angle	0.00
ASHRAE Climate Zone	

Building Summary

Information	Value	Units
Building Name	Building 1	building_name
Net Site Energy	440,346	kBtu
Total Building Area	5,318	ft^2
EUI (Based on Net Site Energy and Total Building Area)	82.80	kBtu/ft^2
OpenStudio Standards Building Type		

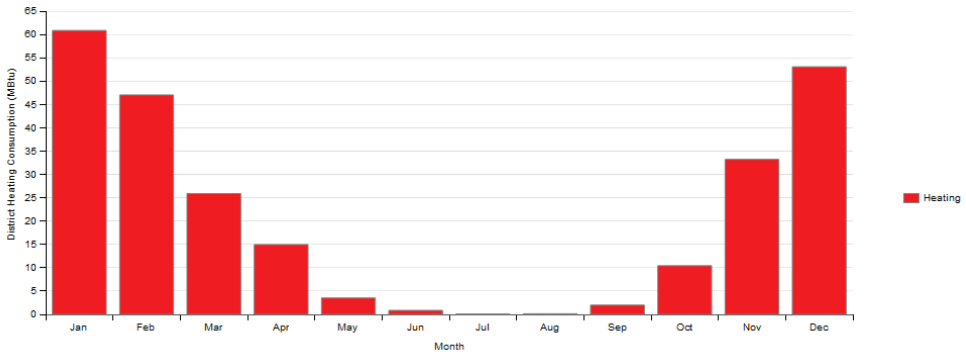
Energy Use - view table





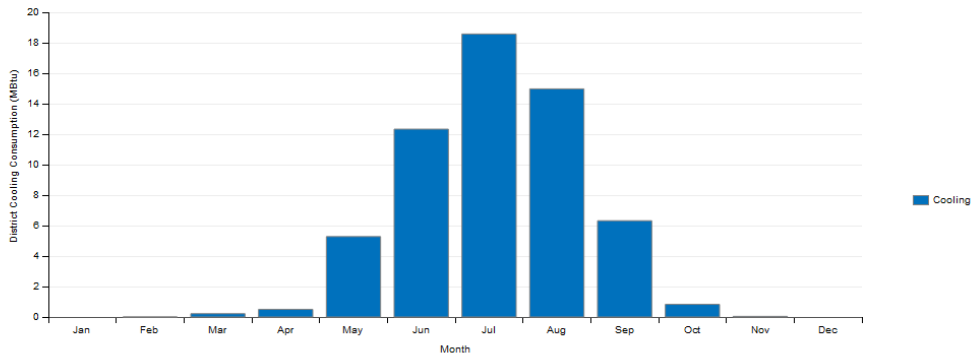
Based on the table, the annual energy consumption in this condition is about 440346 kBtu, equals to 129052.65 kWh.

District Heating Consumption (MBtu) - view table



The fan chart shows that more than half of the energy consumption is in the form of district heating. Meanwhile, electricity and cooling are in a less percentage with a similar value.

District Cooling Consumption (MBtu) - view table



The two bar charts show the mothly value of energy consumption in cooling and heating. It shows that the peak value of heating in winter goes to 60 MBtu, while the peak value of cooling in summer is only 18 MBtu.

Analysis 1 Berlin Wall 1

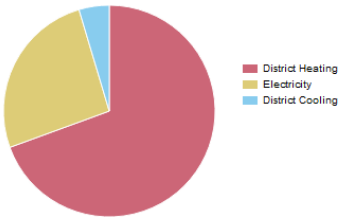
Weather Summary

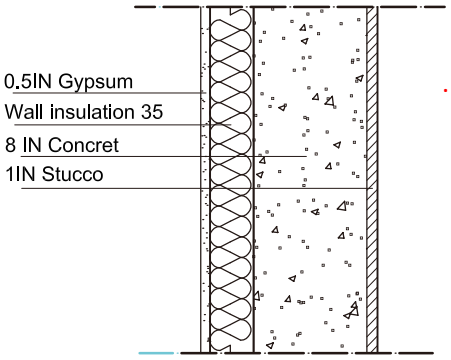
	Value
Weather File	BERLIN - DEU IWEC Data WMO#=103840
Latitude	52.47
Longitude	13.40
Elevation	161 (ft)
Time Zone	1.00
North Axis Angle	0.00
ASHRAE Climate Zone	

Building Summary

Information	Value	Units
Building Name	Building 1	building_name
Net Site Energy	498,201	kBtu
Total Building Area	5,318	ft^2
EUI (Based on Net Site Energy and Total Building Area)	93.67	kBtu/ft^2
OpenStudio Standards Building Type		

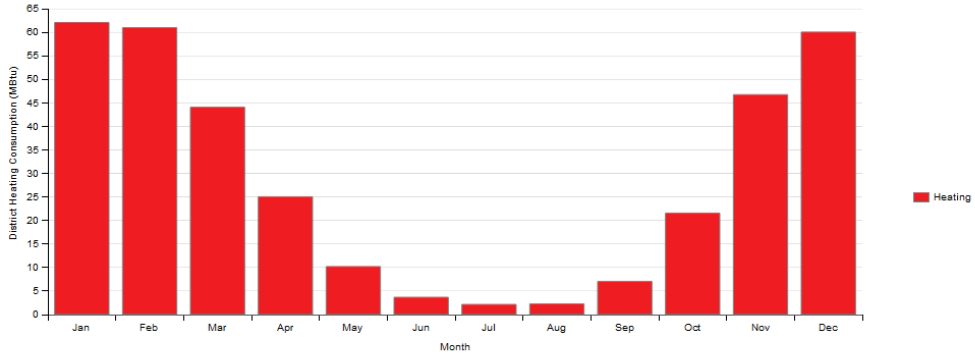
Energy Use - view table





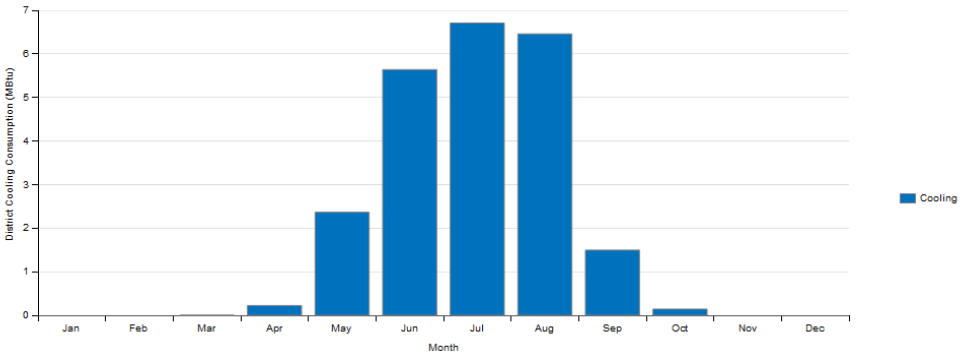
Based on the table, the annual energy consumption in this condition is about 498201 kBtu, equals to 146008.28 kWh.

District Heating Consumption (MBtu) - view table



The fan chart shows that more than half of the energy consumption is in the form of district heating. And the value of energy use in District cooling is the mininum.

District Cooling Consumption (MBtu) - view table



The two bar charts show the mothly value of energy consumption in cooling and heating. It shows that the peak value of heating in winter goes to 60 MBtu, while the peak value of cooling in summer is only 7 MBtu.

Analysis 1 Beijing Wall 1

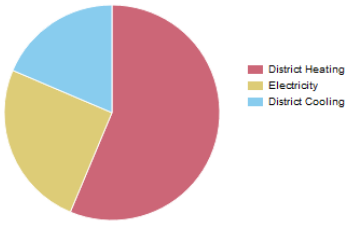
Weather Summary

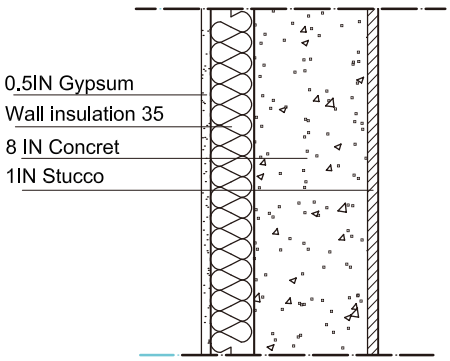
	Value
Weather File	Beijing Beijing CHN CSWD WMO#=545110
Latitude	39.80
Longitude	116.47
Elevation	103 (ft)
Time Zone	8.00
North Axis Angle	0.00
ASHRAE Climate Zone	

Building Summary

Information	Value	Units
Building Name	Building 1	building_name
Net Site Energy	514,977	kBtu
Total Building Area	5,318	ft^2
EUI (Based on Net Site Energy and Total Building Area)	96.83	kBtu/ft^2
OpenStudio Standards Building Type		

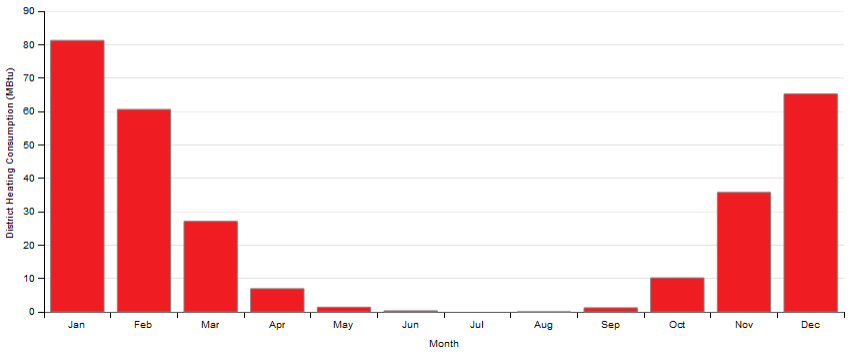
Energy Use - view table





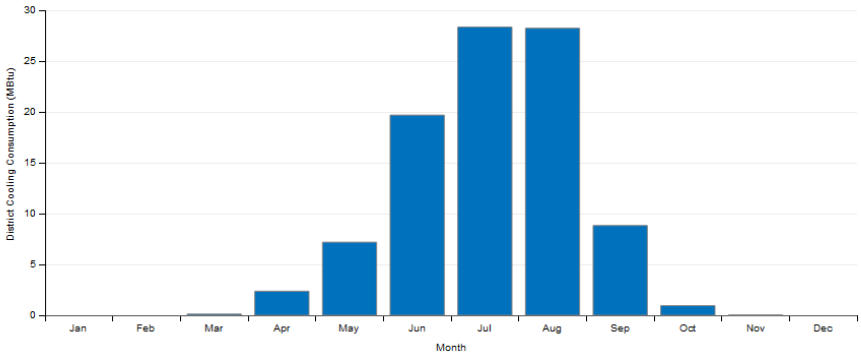
Based on the table, the annual energy consumption in this condition is about 514977 kBtu, equals to 150924.84 kWh.

District Heating Consumption (MBtu) - view table



The fan chart shows that more than half of the energy consumption is in the form of district heating. Meanwhile, electricity and cooling are in a less percentage with a similar value.

District Cooling Consumption (MBtu) - view table



The two bar charts show the mothly value of energy consumption in cooling and heating. It shows that the peak value of heating in winter goes to 80 MBtu, while the peak value of cooling in summer is MBtu.

Analysis 2 Milan Wall 2

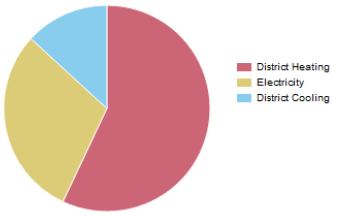
Weather Summary

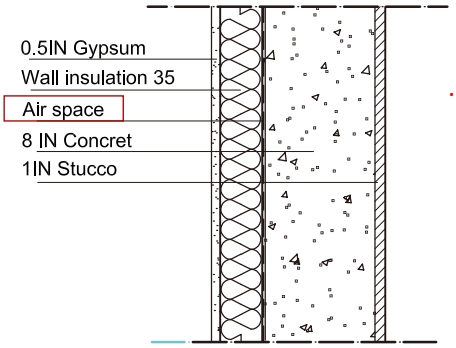
	Value
Weather File	MILAN - ITA IWEC Data WMO#=160660
Latitude	45.62
Longitude	8.73
Elevation	692 (ft)
Time Zone	1.00
North Axis Angle	0.00
ASHRAE Climate Zone	

Building Summary

Information	Value	Units
Building Name	Building 1	building_name
Net Site Energy	433,380	kBtu
Total Building Area	5,318	ft^2
EUI (Based on Net Site Energy and Total Building Area)	81.49	kBtu/ft^2
OpenStudio Standards Building Type		

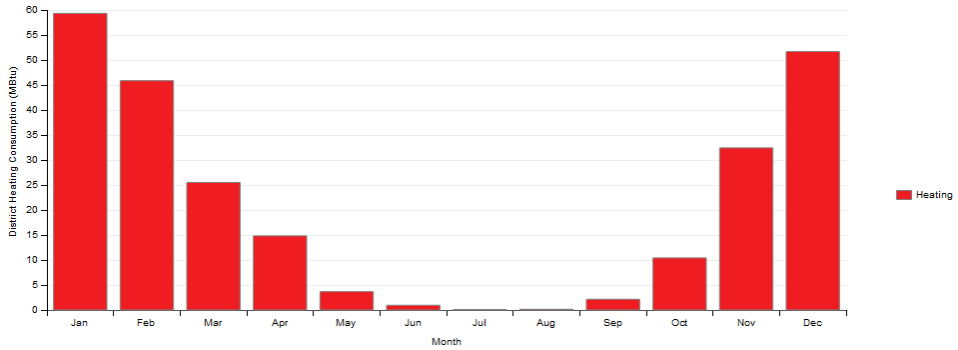
Energy Use - view table





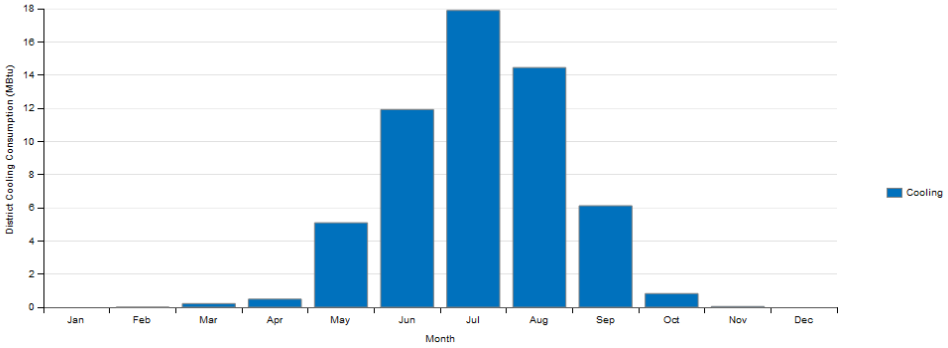
Based on the table, the annual energy consumption in this condition is about 433380kBtu, equals to 127011.12 kWh.

District Heating Consumption (MBtu) - view table



The fan chart shows that more than half of the energy consumption is in the form of district heating. Meanwhile, electricity and cooling are in a less percentage with a similar value.

District Cooling Consumption (MBtu) - view table



The two bar charts show the mothly value of energy consumption in cooling and heating. It shows that the peak value of heating in winter goes to 60 MBtu, while the peak value of cooling in summer is only 18 MBtu.

Analysis 2 Berlin Wall 2

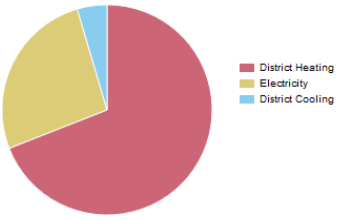
Weather Summary

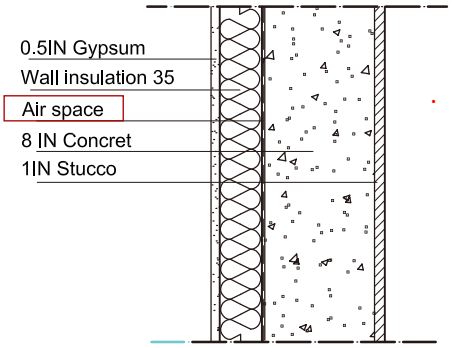
	Value
Weather File	BERLIN - DEU IWEC Data WMO#=103840
Latitude	52.47
Longitude	13.40
Elevation	161 (ft)
Time Zone	1.00
North Axis Angle	0.00
ASHRAE Climate Zone	

Building Summary

Information	Value	Units
Building Name	Building 1	building_name
Net Site Energy	489,822	kBtu
Total Building Area	5,318	ft^2
EUI (Based on Net Site Energy and Total Building Area)	92.10	kBtu/ft^2
OpenStudio Standards Building Type		

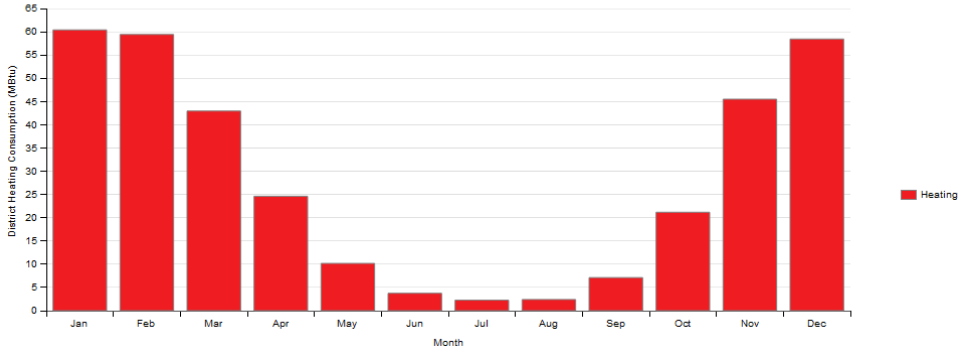
Energy Use - view table





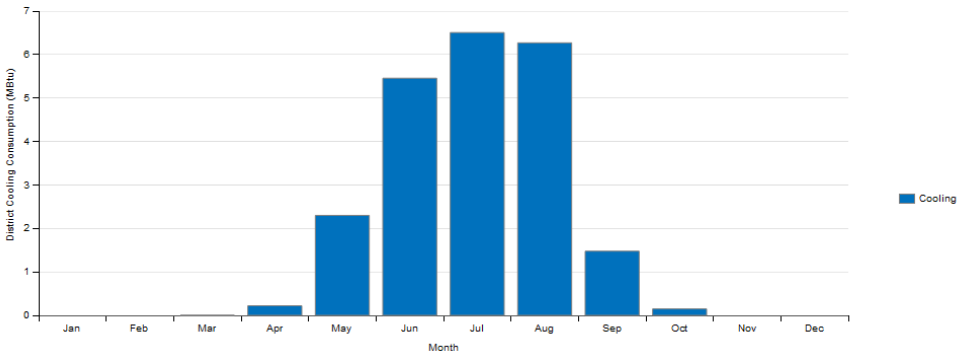
Based on the table, the annual energy consumption in this condition is about 489822 kBtu, equals to 143552.64 kWh.

District Heating Consumption (MBtu) - view table



The fan chart shows that more than half of the energy consumption is in the form of district heating. And the value of energy use in District cooling is the mininum.

District Cooling Consumption (MBtu) - view table



The two bar charts show the mothly value of energy consumption in cooling and heating. It shows that the peak value of heating in winter goes to 60 MBtu, while the peak value of cooling in summer is only 6.5 MBtu.

Analysis 2 Beijing Wall 2

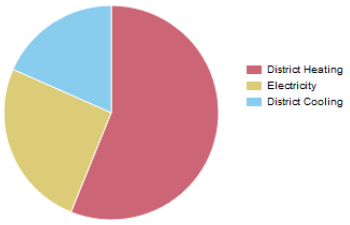
Weather Summary

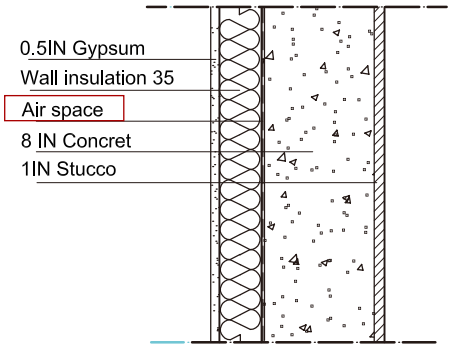
	Value
Weather File	Beijing Beijing CHN CSWD WMO#=545110
Latitude	39.80
Longitude	116.47
Elevation	103 (ft)
Time Zone	8.00
North Axis Angle	0.00
ASHRAE Climate Zone	

Building Summary

Information	Value	Units
Building Name	Building 1	building_name
Net Site Energy	506,826	kBtu
Total Building Area	5,318	ft^2
EUI (Based on Net Site Energy and Total Building Area)	95.30	kBtu/ft^2
OpenStudio Standards Building Type		

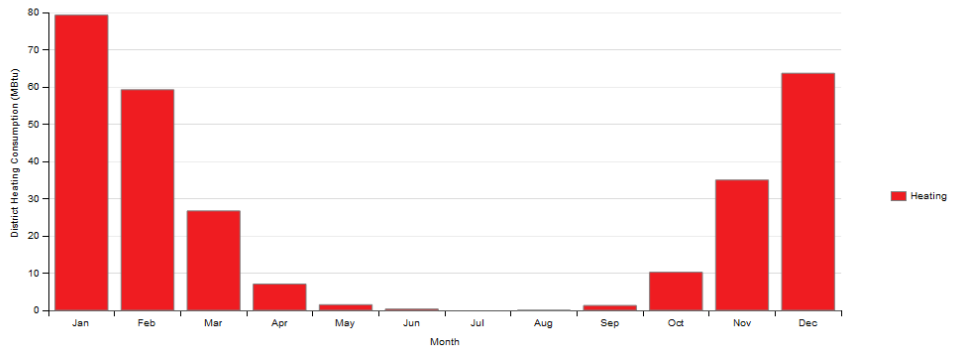
Energy Use - view table





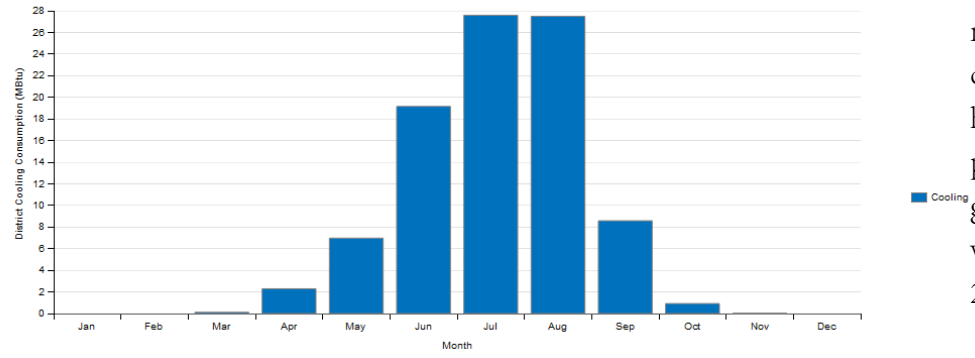
Based on the table, the annual energy consumption in this condition is about 506826 kBtu, equals to 148536.02 kWh.

District Heating Consumption (MBtu) - view table



The fan chart shows that more than half of the energy consumption is in the form of district heating. Meanwhile, electricity and cooling are in a less percentage with a similar value.

District Cooling Consumption (MBtu) - view table



The two bar charts show the mothly value of energy consumption in cooling and heating. It shows that the peak value of heating in winter goes to 80 MBtu, while the peak value of cooling in summer is 28 MBtu.

Analysis 3 Milan Wall 3

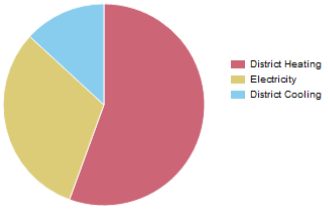
Weather Summary

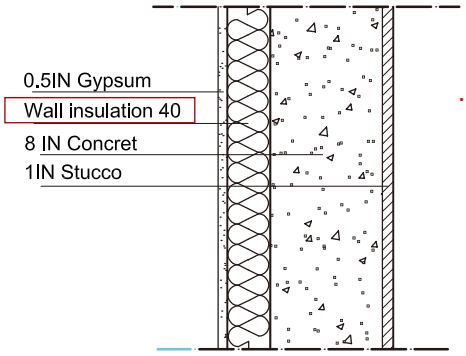
	Value
Weather File	MILAN - ITA IWEC Data WMO#=160660
Latitude	45.62
Longitude	8.73
Elevation	692 (ft)
Time Zone	1.00
North Axis Angle	0.00
ASHRAE Climate Zone	

Building Summary

Information	Value	Units
Building Name	Building 1	building_name
Net Site Energy	413,428	kBtu
Total Building Area	5,318	ft^2
EUI (Based on Net Site Energy and Total Building Area)	77.73	kBtu/ft^2
OpenStudio Standards Building Type		

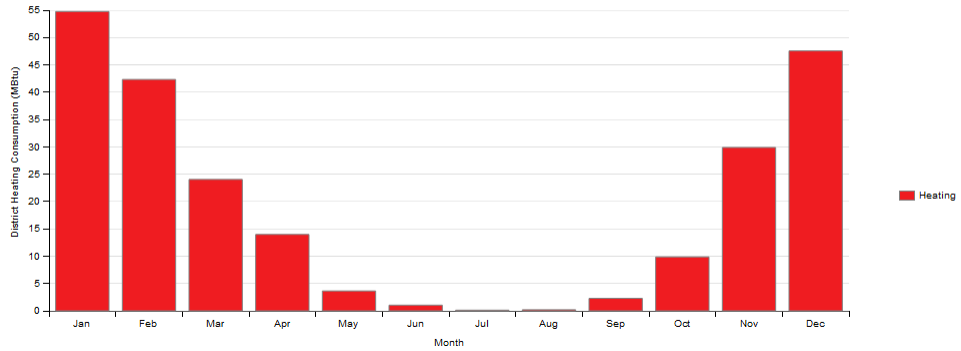
Energy Use - view table





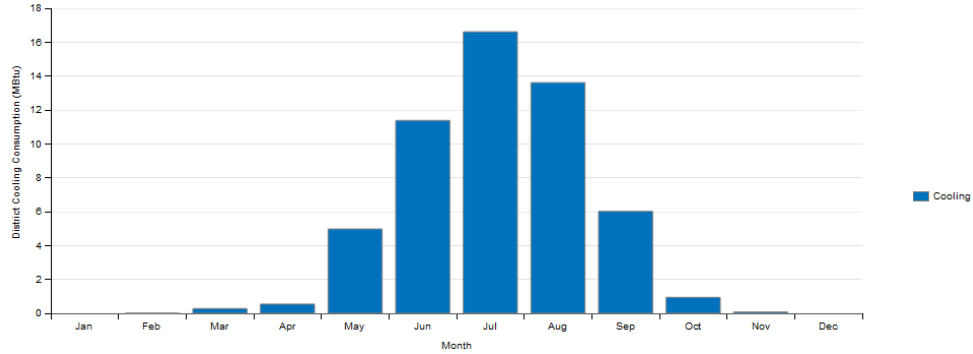
Based on the table, the annual energy consumption in this condition is about 413428 kBtu, equals to 121163.77 kWh.

District Heating Consumption (MBtu) - view table



The fan chart shows that more than half of the energy consumption is in the form of district heating. Meanwhile, electricity and cooling are in a less percentage with a similar value.

District Cooling Consumption (MBtu) - view table



The two bar charts show the mothly value of energy consumption in cooling and heating. It shows that the peak value of heating in winter goes to 60 MBtu, while the peak value of cooling in summer is only 17 MBtu.

Analysis 3 Berlin Wall 3

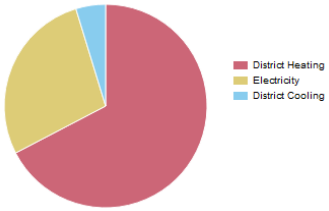
Weather Summary

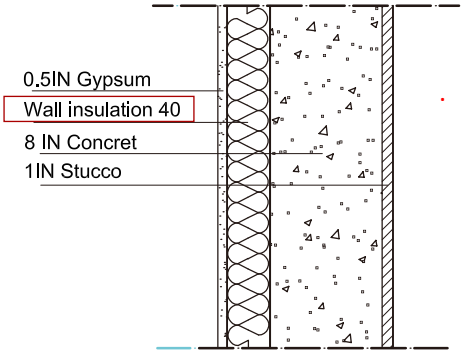
	Value
Weather File	BERLIN - DEU IWEC Data WMO#=103840
Latitude	52.47
Longitude	13.40
Elevation	161 (ft)
Time Zone	1.00
North Axis Angle	0.00
ASHRAE Climate Zone	

Building Summary

Information	Value	Units
Building Name	Building 1	building_name
Net Site Energy	463,359	kBtu
Total Building Area	5,318	ft^2
EUI (Based on Net Site Energy and Total Building Area)	87.12	kBtu/ft^2
OpenStudio Standards Building Type		

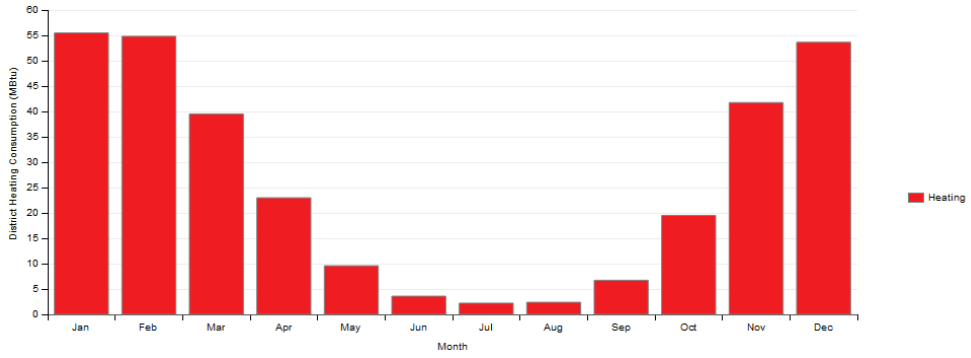
Energy Use - view table





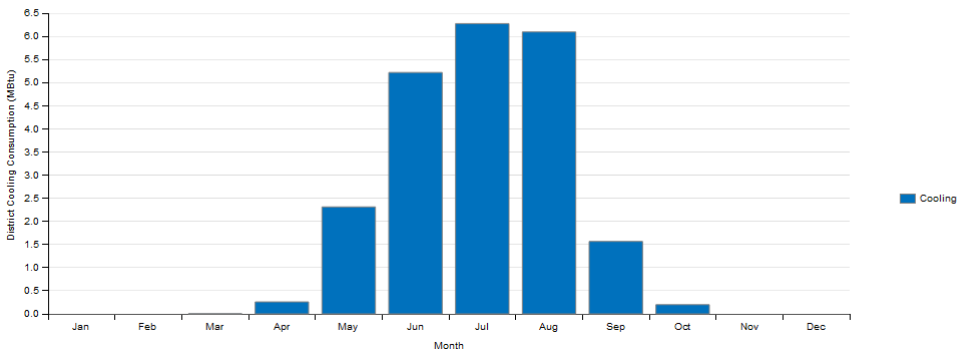
Based on the table, the annual energy consumption in this condition is about 463359 kBtu, equals to 135797.10 kWh.

District Heating Consumption (MBtu) - view table



The fan chart shows that more than half of the energy consumption is in the form of district heating. And the value of energy use in District cooling is the mininum.

District Cooling Consumption (MBtu) - view table



The two bar charts show the mothly value of energy consumption in cooling and heating. It shows that the peak value of heating in winter goes to 60 MBtu, while the peak value of cooling in summer is only 6.3 MBtu.

Analysis 3 Beijing Wall 3

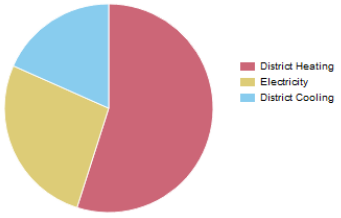
Weather Summary

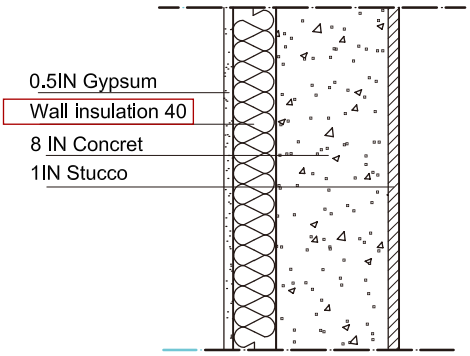
	Value
Weather File	Beijing Beijing CHN CSWD WMO#=545110
Latitude	39.80
Longitude	116.47
Elevation	103 (ft)
Time Zone	8.00
North Axis Angle	0.00
ASHRAE Climate Zone	

Building Summary

Information	Value	Units
Building Name	Building 1	building_name
Net Site Energy	483,472	kBtu
Total Building Area	5,318	ft^2
EUI (Based on Net Site Energy and Total Building Area)	90.90	kBtu/ft^2
OpenStudio Standards Building Type		

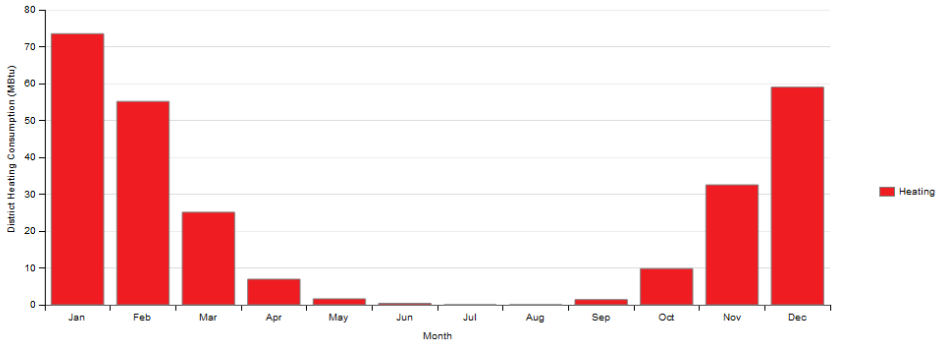
Energy Use - view table





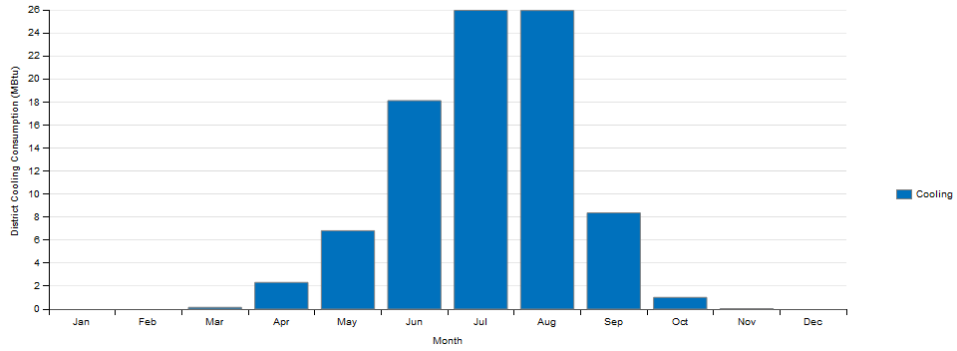
Based on the table, the annual energy consumption in this condition is about 483472 kBtu, equals to 141691.64 kWh.

District Heating Consumption (MBtu) - view table



The fan chart shows that more than half of the energy consumption is in the form of district heating. Meanwhile, electricity and cooling are in a less percentage with a similar value.

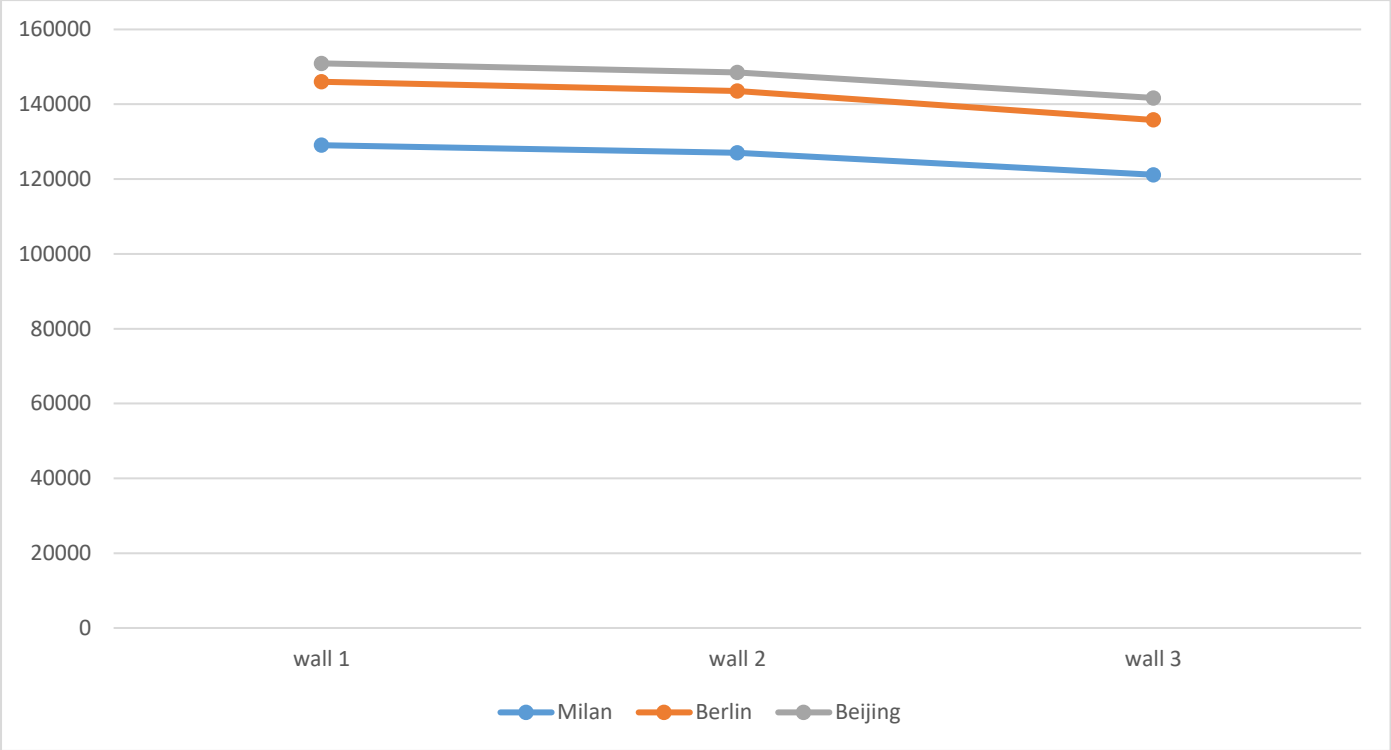
District Cooling Consumption (MBtu) - view table



The two bar charts show the mothly value of energy consumption in cooling and heating. It shows that the peak value of heating in winter goes to 73 MBtu, while the peak value of cooling in summer is 28 MBtu.

Conclusion

The chart and table below show the annual energy consumption in different conditions.



Energy consumption (kwh)	Milan	Berlin	Beijing
wall 1	129052.7	146008.3	150924.8
wall 2	127011.1	143552.6	148536
wall 3	121163.8	135797.1	141691.6

Two kinds of conclusions are made based on the analysis of all the data.

First, comparing the value of energy consumption of different types of walls in the same city, which shows the influence of building constructions, we can get a conclusion that building constructed by wall type 3 has the least energy consumption because this kind of construction has an efficient insulation layer than usual wall.

Second, comparing the value of energy consumption of the same type of wall in different cities, which shows the influence of weather, we can get a conclusion that Milan has the least energy consumption.