TECHNICAL REPORT

Course: Technical Environmental System - Professor: Renzo Marchesi - AY 2017/2018

Gudarz Shahrivar - Bardia Zamanizadeh - Erik Raffaini - Mahkameh Majidifar

TECHNICAL REPORT

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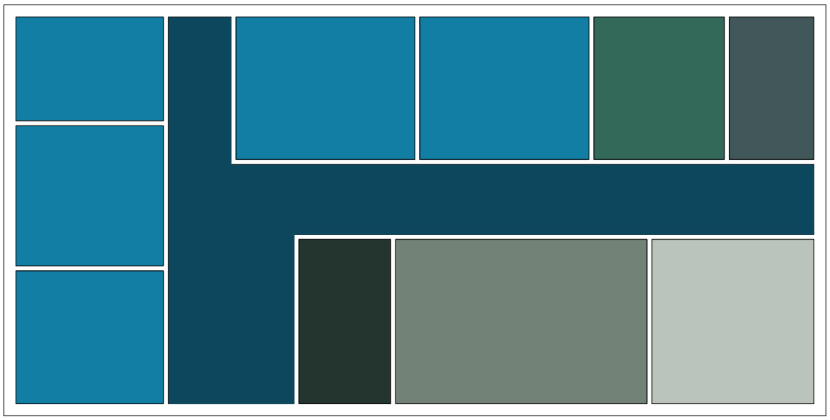
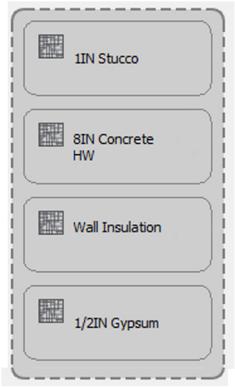
PRESENTATION OF THE BUILDING

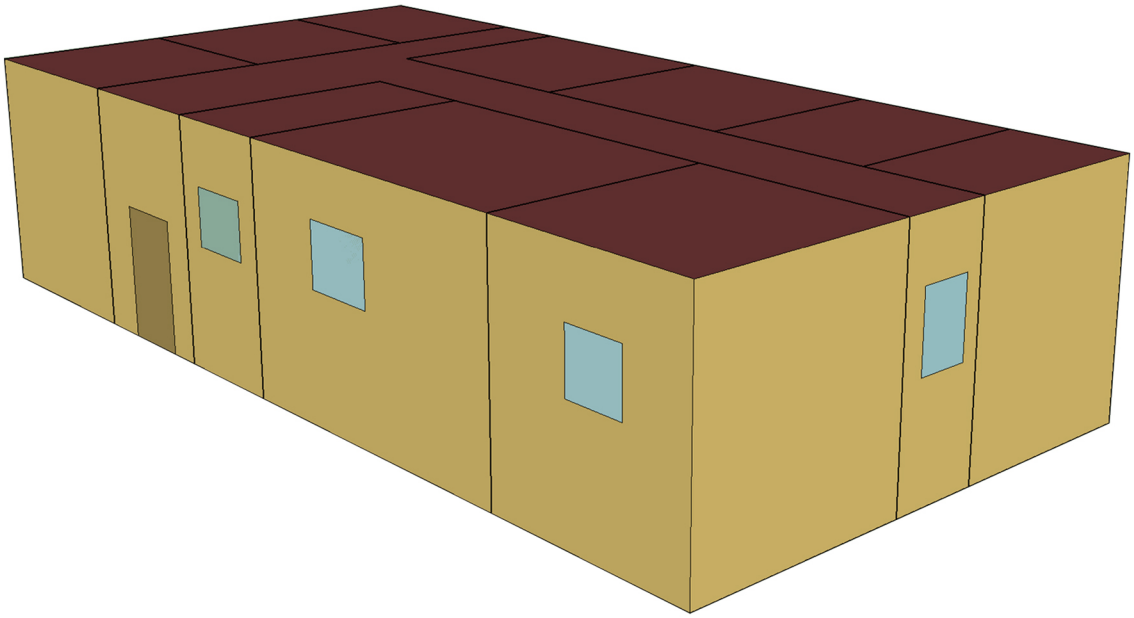


The building that is chosen for this project is an office situated in south Iran, city of Shiraz.
Te office has only one floor. It's organized of different parts: the main area is an open corridor, one conference room, and five small closed offices. Other spaces in this space is printing room, restroom and break room.
Te total area of this building is 144.5 sq.

- 189.1 - 2009 - Office - ClosedOffice - CZ1-3
- 189.1 - 2009 - Office - PrintRoom - CZ1-3
- 189.1 - 2009 - Office - RestRoom - CZ1-3
- 189.1 - 2009 - Office - BreakRoom - CZ1-3
- 189.1 - 2009 - Office - Conferance - CZ1-3
- 189.1 - 2009 - Office - Storage - CZ1-3
- 189.1 - 2009 - Office - Corridor - CZ1-3

Default Wall - Orgnizatio





Information	Value	Units
Net Site Energy	96,308	kBtu
Total Building Area	144.5	m^2
EUI (Based on Net Site Energy and Total Building Area)	61.92	kBtu/ft^2

PRESENTATION OF THE BUILDING

PROCEDURE USED

At the bigining we find three different locations with different climates, city shiraz with modarate climate, city Bandar Abbas with humid and hot climate condition and city Tabriz with coolder climate. Then we draw the plan and model it on Sketch Up with the OpenStudio plug-in tool. After we draw the diagromatic plan in Sketch Up In order to have a volume we use the tool "create space from diagram" inserting the height and the numbers of floor.

After we had our model, we used the tool "surface matching" to define the interior and the exterior walls. This step is required to determine the solar and wind exposure of each wall. After this we inserted the windows by clicking on different spaces and draw the windows with pen tool, we do the same for the entrence door.

Afer drawing the windows, we need to determine the function of each space by using the tool "set attributes for selected space". Beacuase this procedure needs to be done for each room one by one. We have to repeat these steps to include the thermal consideration.

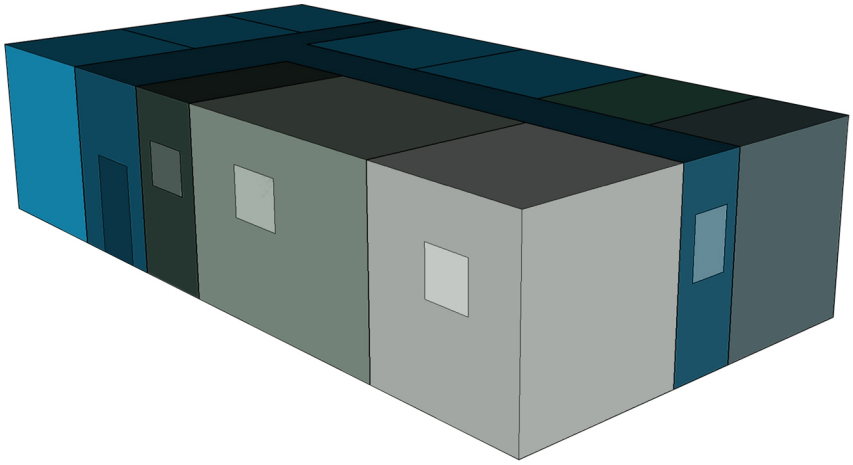
We save the project as an OpenStudio file (*.osm format) and then we open it with OpenStudio.

In this point we inserted weather file for our cities and then inserted file for "Design Days". This procedure was reapeted for every city

This file gives the correct characteristics of an average year weather in our cities. It is possible to change or update some information.

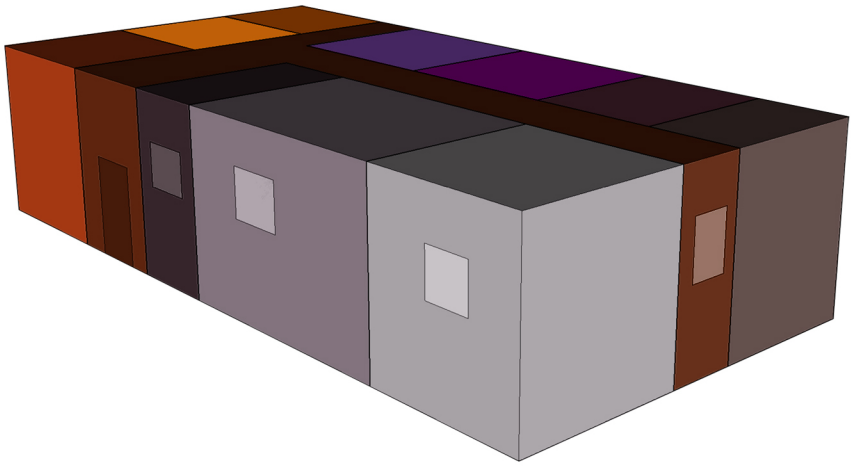
In the end we run the simulation for every city and we got this resualts that we present here:

Spaces Types



- 189.1 - 2009 - Office - ClosedOffice
- 189.1 - 2009 - Office - PrintRoom
- 189.1 - 2009 - Office - RestRoom
- 189.1 - 2009 - Office - BreakRoom
- 189.1 - 2009 - Office - Conferance
- 189.1 - 2009 - Office - Storage
- 189.1 - 2009 - Office - Corridor

Thermal Zones



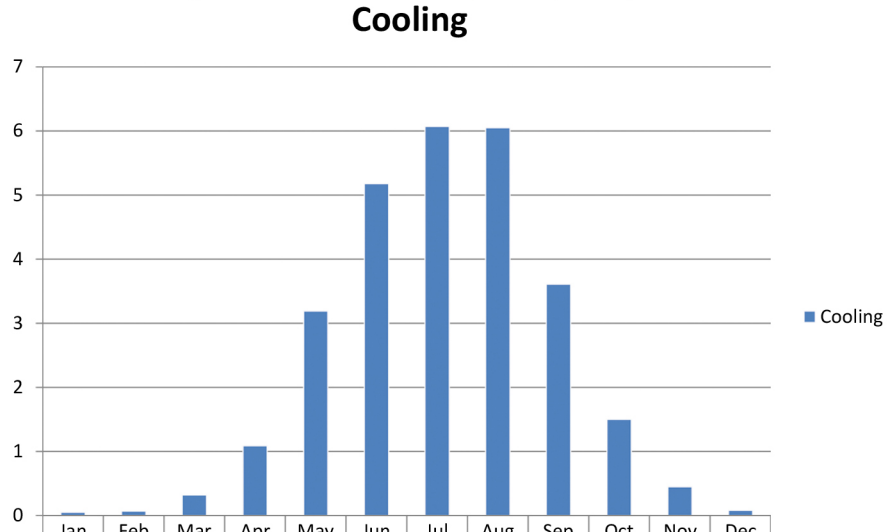
- Thermal Zone 1
- Thermal Zone 2
- Thermal Zone 3
- Thermal Zone 4
- Thermal Zone 5
- Thermal Zone 6
- Thermal Zone 7
- Thermal Zone 8
- Thermal Zone 9
- Thermal Zone 10
- Thermal Zone 11

First Simulation - Modified Wall

City: Shiraz

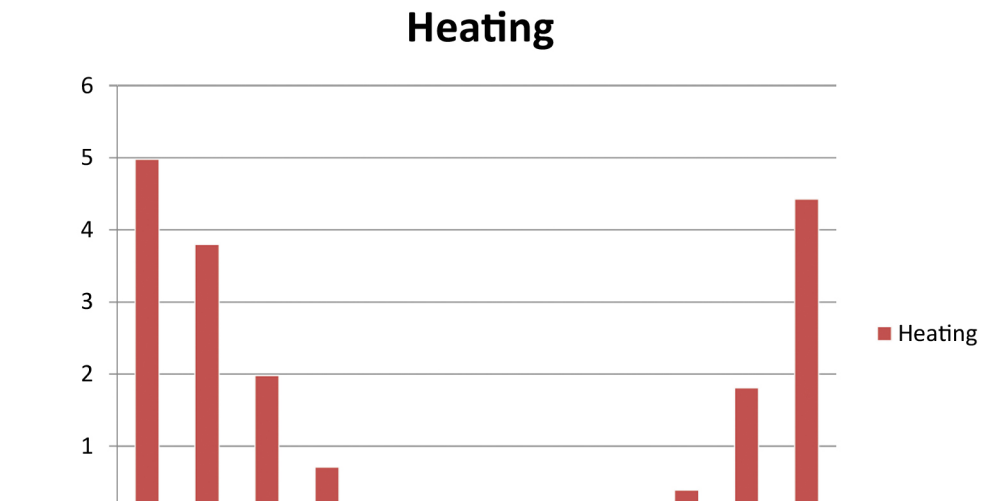
Monthly Overview

District Cooling Overview - Consumption (MBtu)



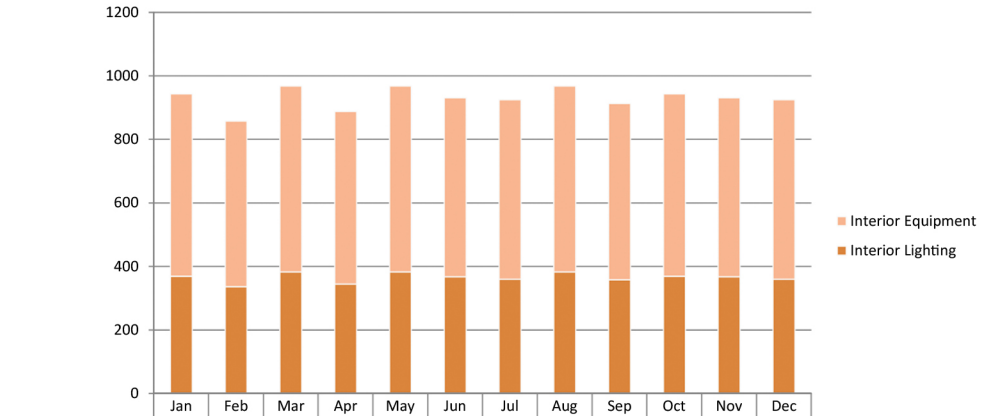
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cooling	0.05	0.07	0.32	1.09	3.19	5.18	6.07	6.05	3.61	1.5	0.45	0.08

District Heating Overview - Consumption (MBtu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heating	4.98	3.8	1.98	0.71	0.06	0			0.03	0.39	1.81	4.43

Electricity Overview - Consumption (kWh)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Interior Equipment	573.83	520.59	584.99	543.42	584.99	563.52	564.88	584.99	554.58	573.83	563.52	564.88
Interior Lighting	369.03	336.71	382.74	344.18	382.74	367.39	359.52	382.74	357.89	369.03	367.39	359.52

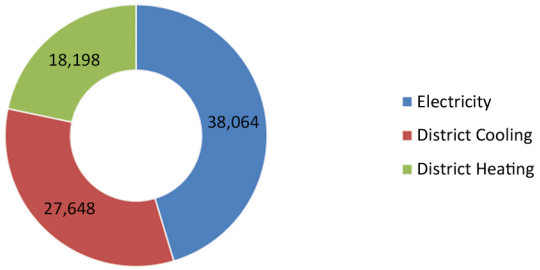
Shiraz

Shiraz's climate has distinct seasons, and is overall classed as a hot semi-arid climate (Köppen climate classification BSh), though it is only a little short of a hot-summer Mediterranean climate (Köppen climate classification Csa). Summers are hot, with a July average high of 38.8 °C (101.8 °F). Winters are cool, with average low temperatures below freezing in December and January. Around 300 mm (12 in) of rain falls each year, almost entirely in the winter months.

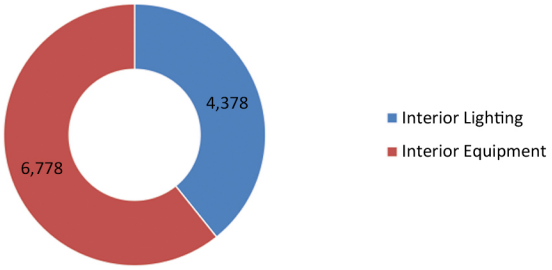
The highest record temperature was 43.2 °C (109.8 °F) on 12 July 1998 and the lowest record temperature was −14 °C (7 °F) on 5 January 1973.

Annual Overview

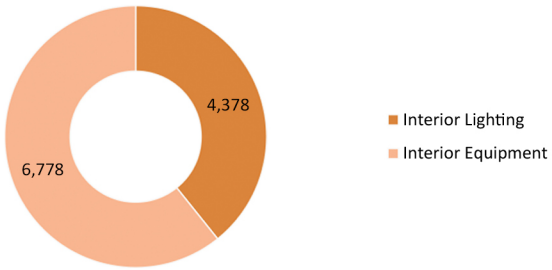
Consumption (kBtu)



Consumption (kWh)



Consumption (kWh)

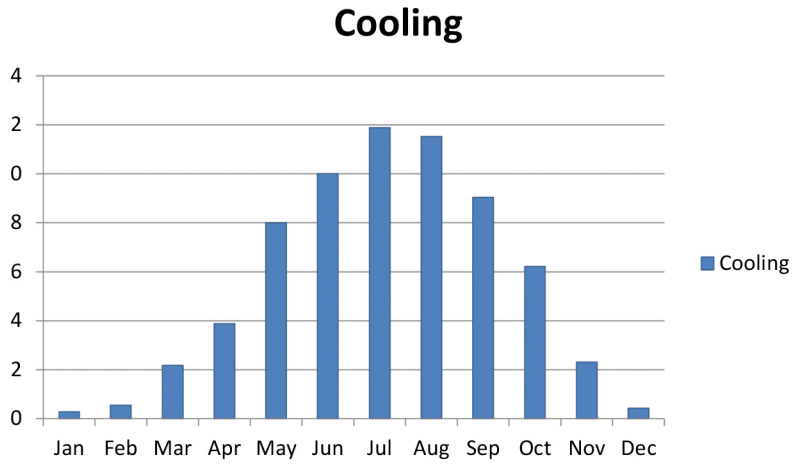


First Simulation - Modified Wall

City: Bandar Abbas

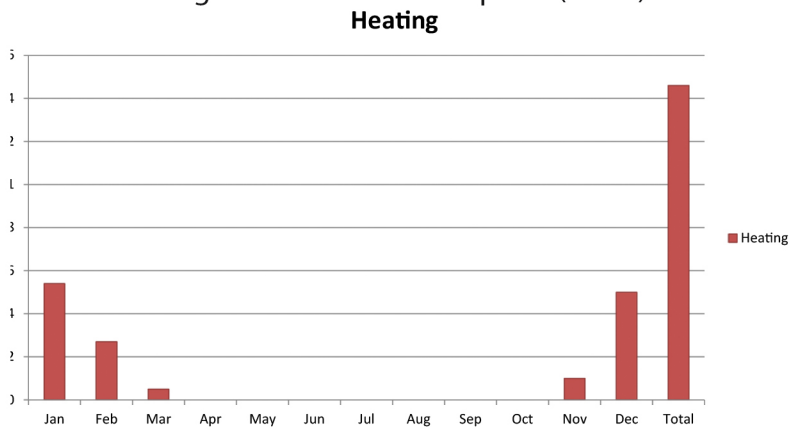
Monthly Overview

District Cooling Overview - Consumption (MBtu)



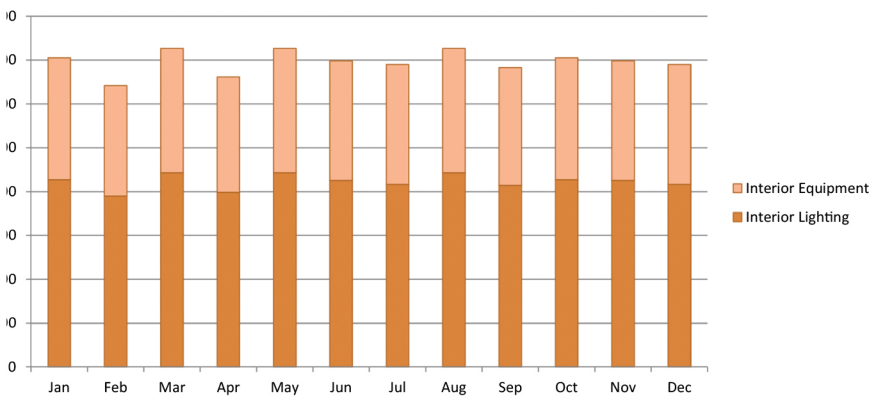
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cooling	0.29	0.55	2.18	3.88	8	10	11.89	11.53	9.04	6.22	2.32	0.43

District Heating Overview - Consumption (MBtu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heating	0.54	0.27	0.05	0							0.1	0.5

Electricity Overview - Consumption (kWh)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Interior Lighting	427.27	389.86	443.15	398.51	443.15	425.39	416.27	443.15	414.38	427.27	425.39	416.27
Interior Equipment	278.08	252.28	283.49	263.34	283.49	273.09	273.75	283.49	268.75	278.08	273.09	273.75

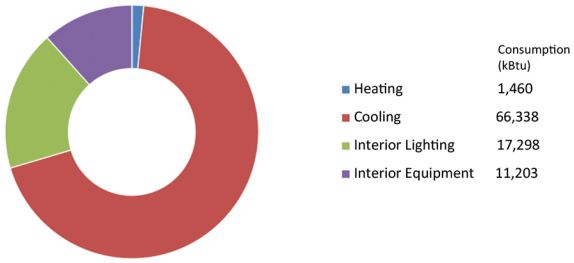
Bandar Abbas

Bandar Abbas has a hot desert climate (Köppen climate classification BWh). Maximum temperature in summers can reach 49 °C (120 °F) while in winters the minimum temperature may drop to 5 °C (41 °F). The annual rainfall is around 170 millimetres (6.7 in) and the average relative humidity is 65%.

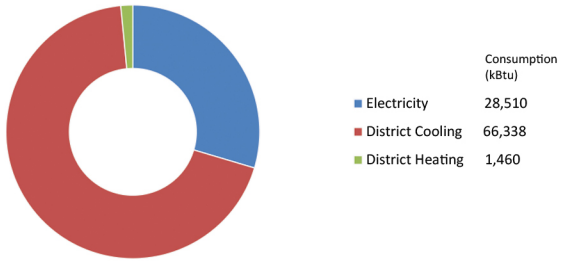
In the summer, Bandar Abbas sees some of the highest average dew points of any city in the world, averaging 27 °C (81 °F) and frequently exceeding 30 °C (86 °F). As a result, heat indices generally top 50 °C (122 °F) for most days during the summer. This immense humidity causes summer diurnal ranges to be lower than in most desert climates, and is a result of air flow from the warm waters of the Persian Gulf.

Annual Overview

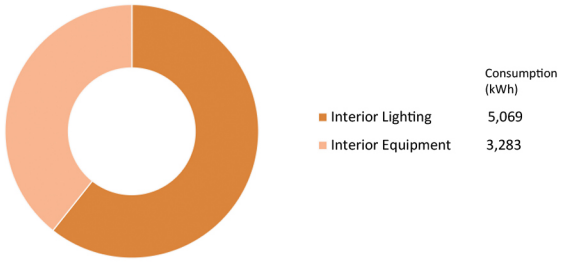
Consumption (kBtu)



Consumption (kBtu)



Consumption (kWh)

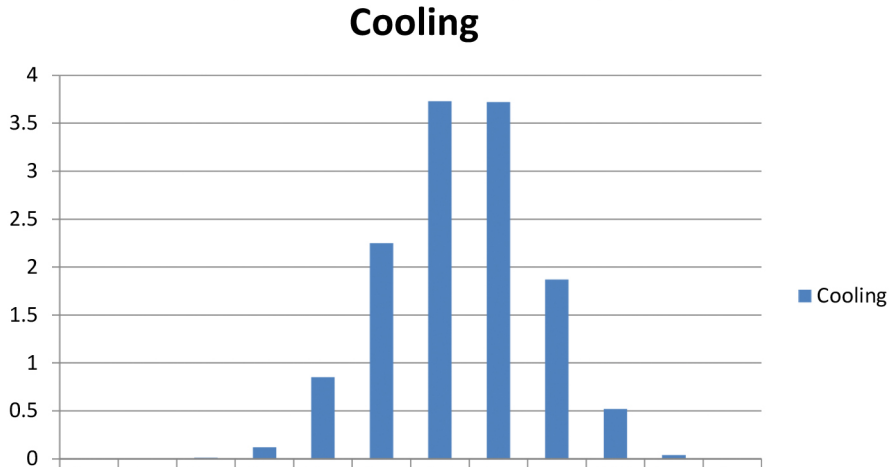


First Simulation - Modified Wall

City: Tabriz

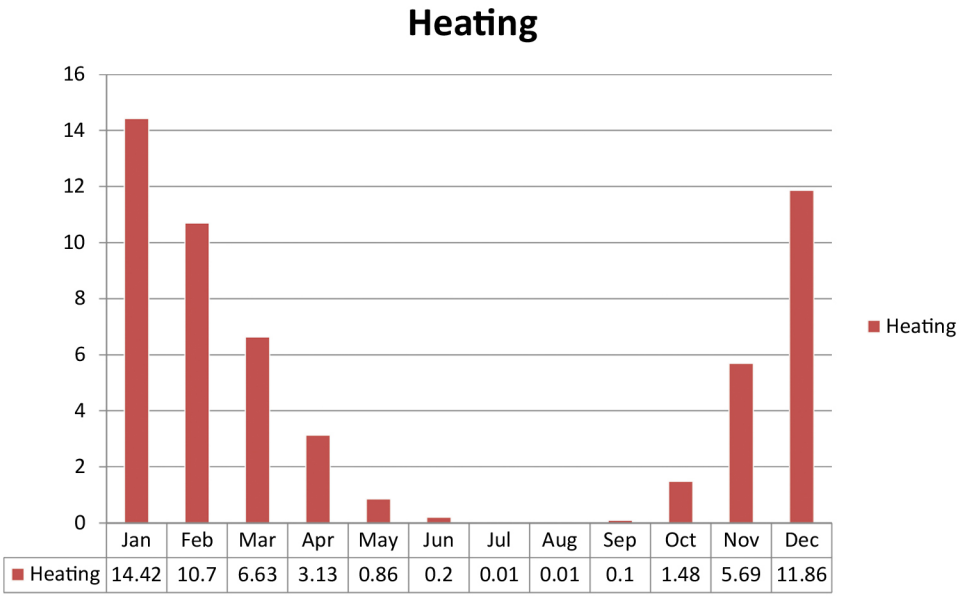
Monthly Overview

District Cooling Overview - Consumption (MBtu)



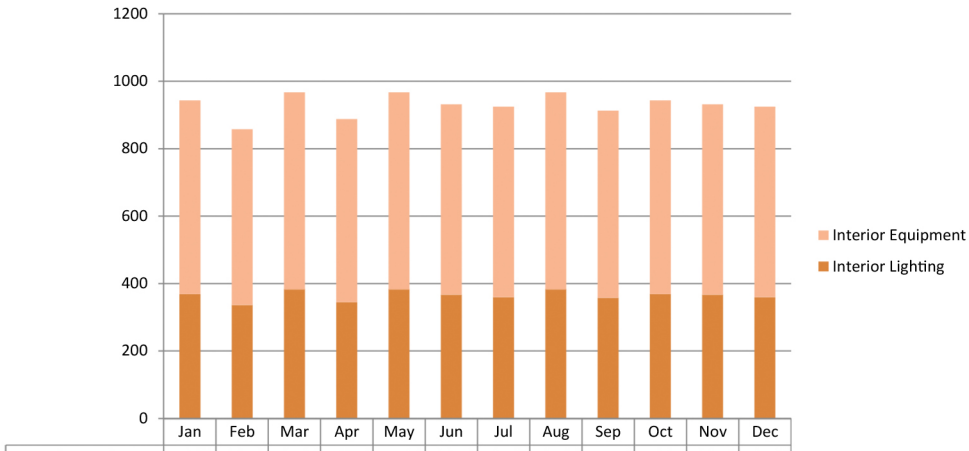
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cooling			0.01	0.12	0.85	2.25	3.73	3.72	1.87	0.52	0.04	

District Heating Overview - Consumption (MBtu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heating	14.42	10.7	6.63	3.13	0.86	0.2	0.01	0.01	0.1	1.48	5.69	11.86

Electricity Overview - Consumption (kWh)



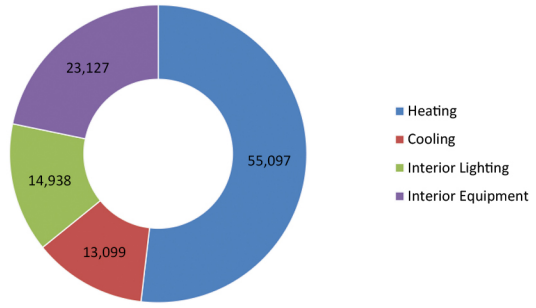
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Interior Equipment	573.83	520.59	584.99	543.42	584.99	563.52	564.88	584.99	554.58	573.83	563.52	564.88
Interior Lighting	369.03	336.71	382.74	344.18	382.74	367.39	359.52	382.74	357.89	369.03	367.39	359.52

Tabriz

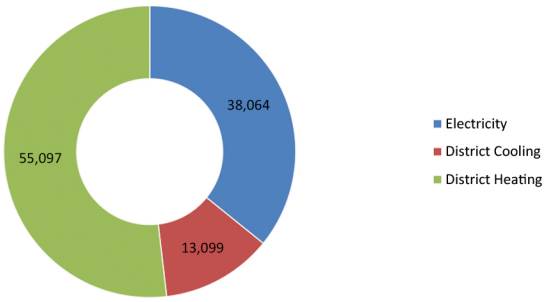
Tabriz has a semi-arid climate with regular seasons (Köppen BSk). The annual precipitation is around 280 millimetres (11 in), a good deal of which falls as snow during the winter months and rain in spring and autumn. The city enjoys mild and fine climate in spring, dry and semi-hot in summer, humid and rainy in autumn and snowy cold in winter. The average annual temperature is 12.6 °C (54.7 °F). Cool winds blow from east to west mostly in summer. The inhabitants' overall evaluation of climate is pretty negative; there is a popular saying that (in Tabriz, six months of the year are winter and the other six months are a nuisance).

Annual Overview

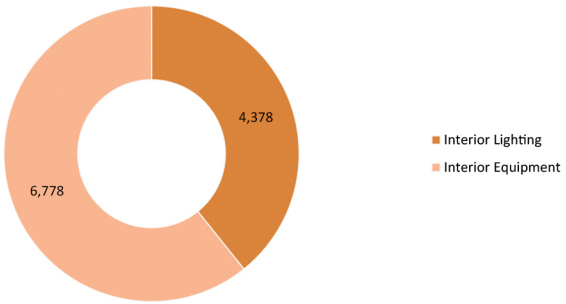
Consumption (kBtu)



Consumption (kBtu)



Consumption (kWh)

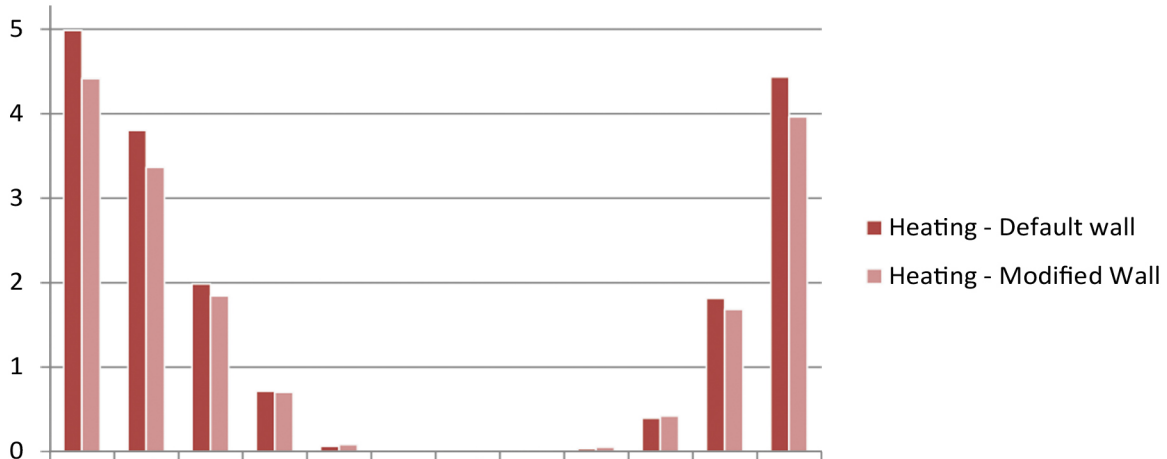


Second Simulation - Modified Wall

City: Shiraz

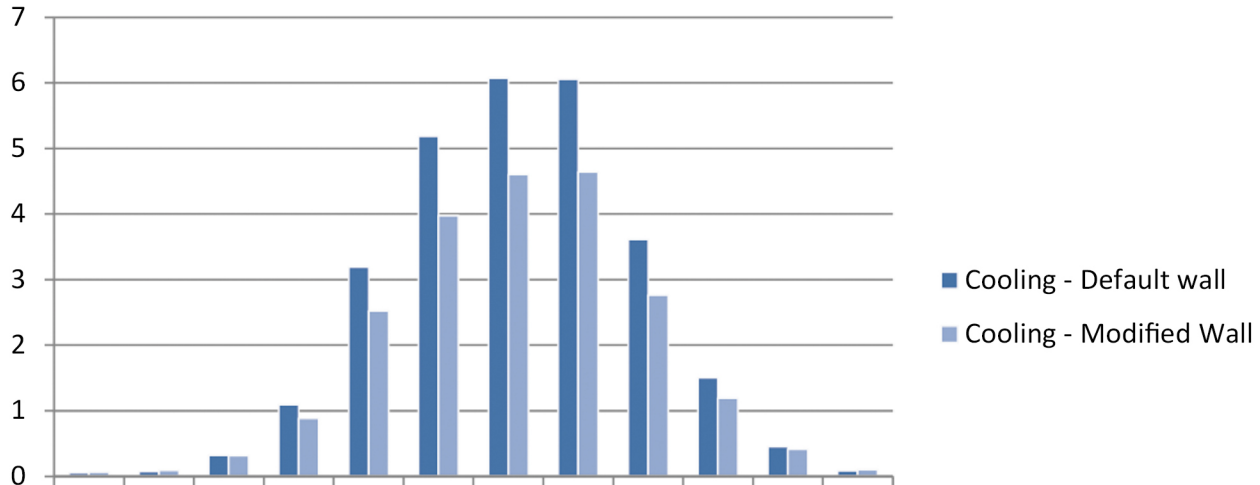
Monthly Overview

District Heating Overview - Consumption (MBtu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heating - Default wall	4.98	3.8	1.98	0.71	0.06	0			0.03	0.39	1.81	4.43
Heating - Modified Wall	4.41	3.36	1.84	0.7	0.08	0	0	0	0.05	0.42	1.68	3.96

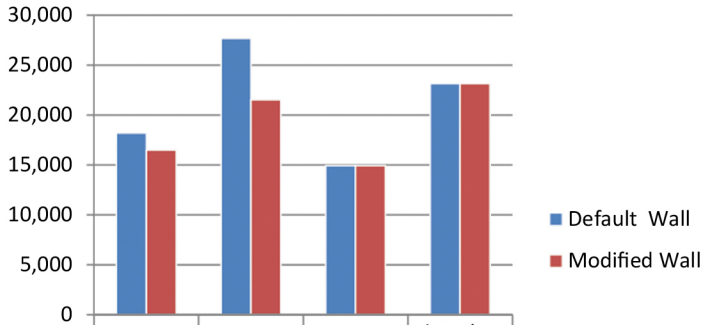
District Cooling Overview - Consumption (MBtu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cooling - Default wall	0.05	0.07	0.32	1.09	3.19	5.18	6.07	6.05	3.61	1.5	0.45	0.08
Cooling - Modified Wall	0.06	0.09	0.31	0.88	2.52	3.97	4.6	4.64	2.76	1.19	0.41	0.1

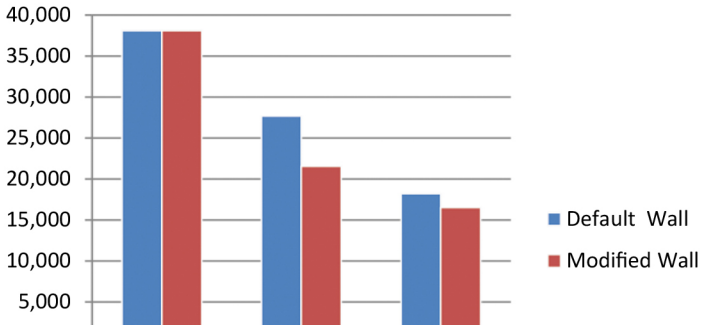
Annual Overview

End Use Overview - Consumption (kBtu)



	Heating	Cooling	Interior Lighting	Interior Equipment
Default Wall	18,198	27,648	14,938	23,127
Modified Wall	16,492	21,525	14,938	23,127

Energy Use Overview - Consumption (kBtu)



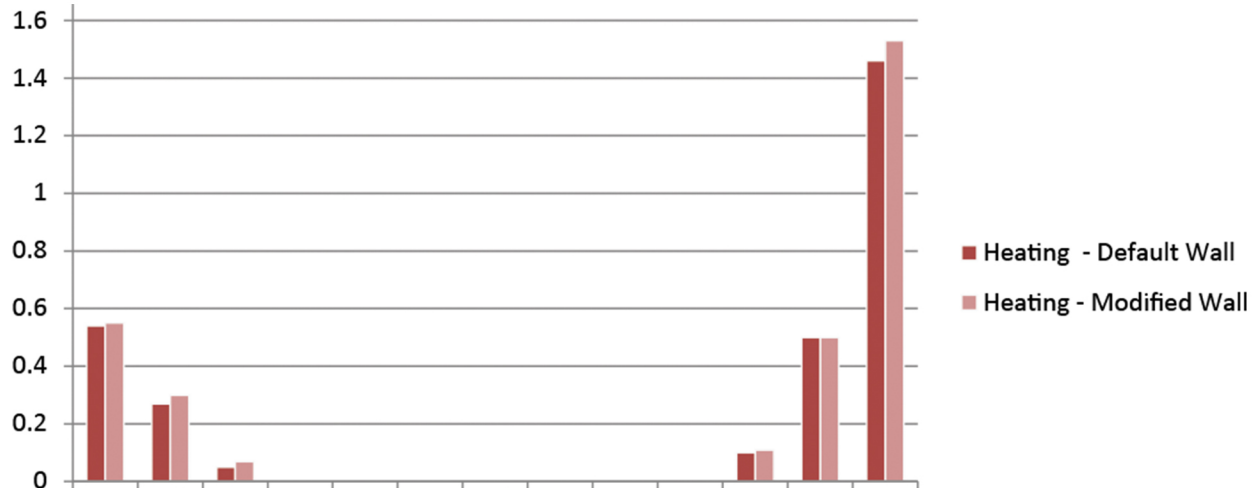
	Electricity	District Cooling	District Heating
Default Wall	38,064	27,648	18,198
Modified Wall	38,064	21,525	16,492

Second Simulation - Modified Wall

City: Bandar Abbas

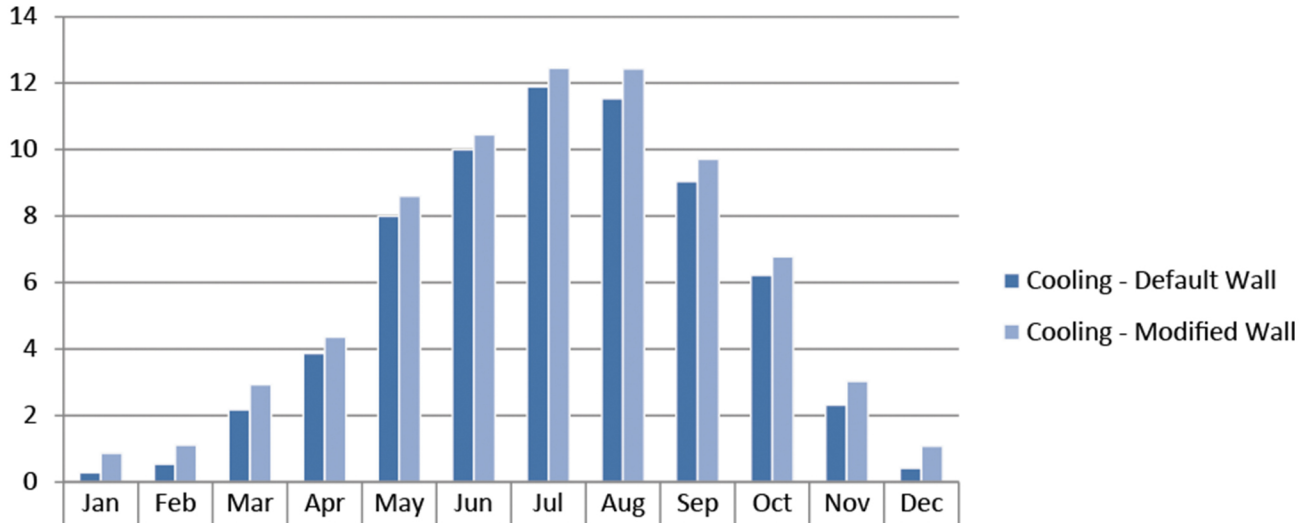
Monthly Overview

District Heating Overview - Consumption (MBtu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Heating - Default Wall	0.54	0.27	0.05	0							0.1	0.5	1.46
Heating - Modified Wall	0.55	0.3	0.07	0							0.11	0.5	1.53

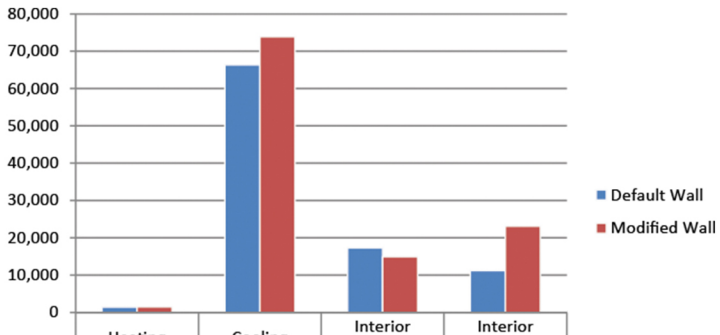
District Cooling Overview - Consumption (MBtu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cooling - Default Wall	0.29	0.55	2.18	3.88	8	10	11.89	11.53	9.04	6.22	2.32	0.43
Cooling - Modified Wall	0.88	1.12	2.94	4.37	8.6	10.45	12.45	12.43	9.71	6.78	3.04	1.09

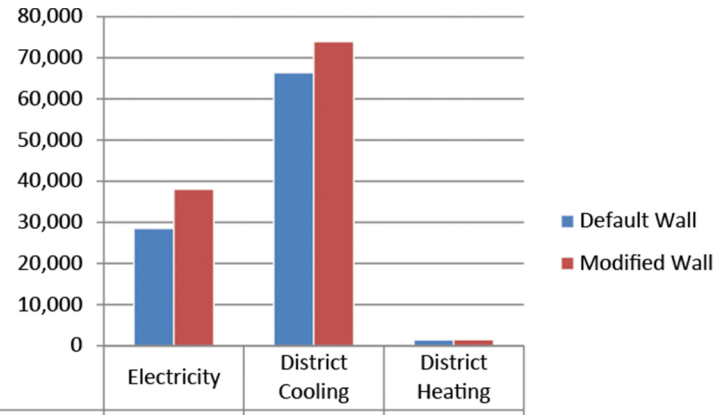
Annual Overview

End Use Overview - Consumption (kBtu)



	Heating	Cooling	Interior Lighting	Interior Equipment
Default Wall	1,460	66,338	17,298	11203
Modified Wall	1,526	73,854	14,938	23,127

Energy Use Overview - Consumption (kBtu)



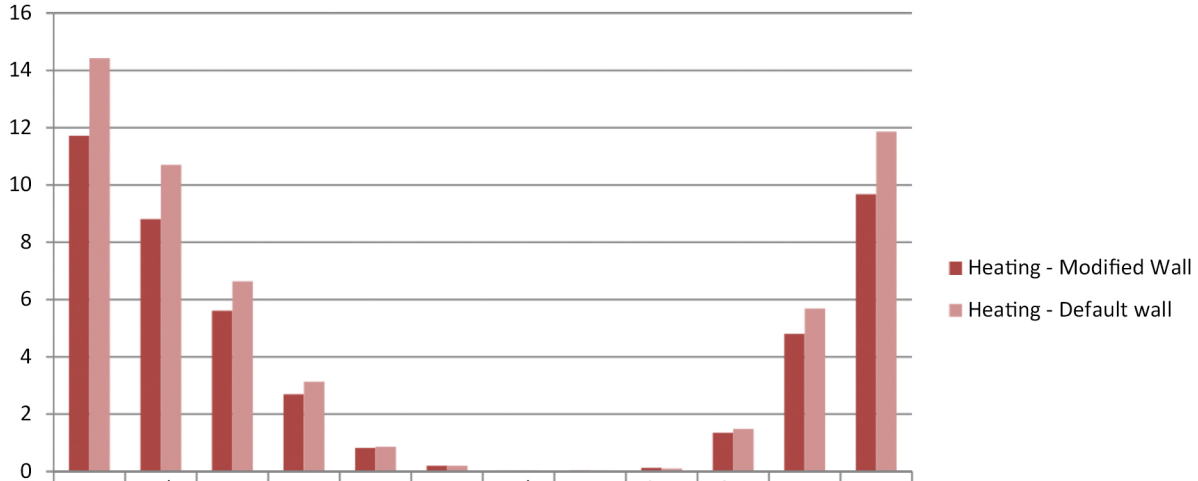
	Electricity	District Cooling	District Heating
Default Wall	28,510	66,338	1,460
Modified Wall	38,064	73,854	1,526

Second Simulation - Modified Wall

City: Tabriz

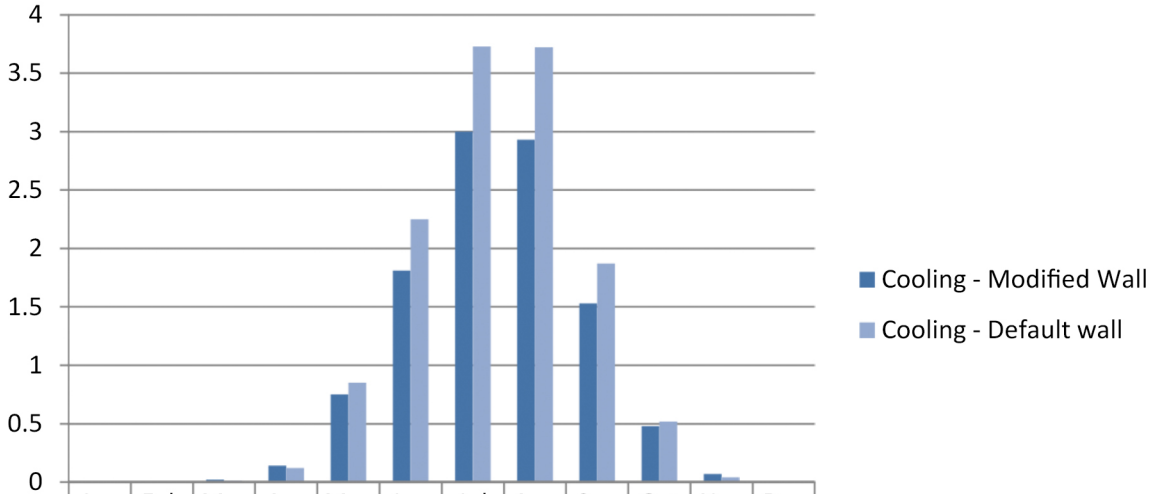
Monthly Overview

District Heating Overview - Consumption (MBtu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heating - Modified Wall	11.71	8.81	5.61	2.69	0.82	0.2	0.01	0.02	0.13	1.35	4.8	9.68
Heating - Default wall	14.42	10.7	6.63	3.13	0.86	0.2	0.01	0.01	0.1	1.48	5.69	11.86

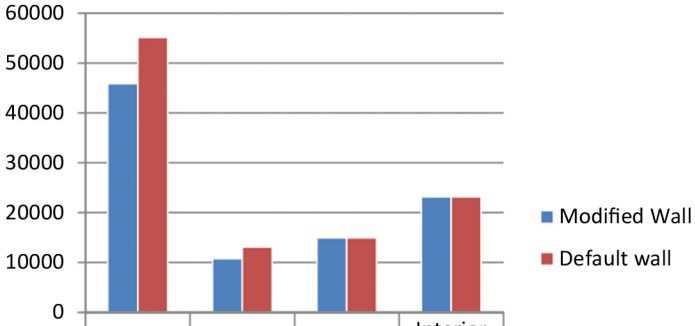
District Cooling Overview - Consumption (MBtu)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cooling - Modified Wall		0	0.02	0.14	0.75	1.81	3	2.93	1.53	0.48	0.07	0
Cooling - Default wall			0.01	0.12	0.85	2.25	3.73	3.72	1.87	0.52	0.04	

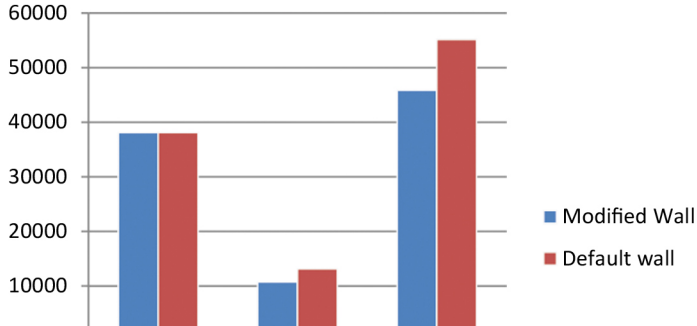
Annual Overview

End Use Overview - Consumption (kBtu)



	Heating	Cooling	Interior Lighting	Interior Equipment
Modified Wall	45836	10729	14938	23127
Default wall	55,097	13,099	14,938	23,127

Energy Use Overview - Consumption (kBtu)



	Electricity	District Cooling	District Heating
Modified Wall	38064	10729	45836
Default wall	38,064	13,099	55,097

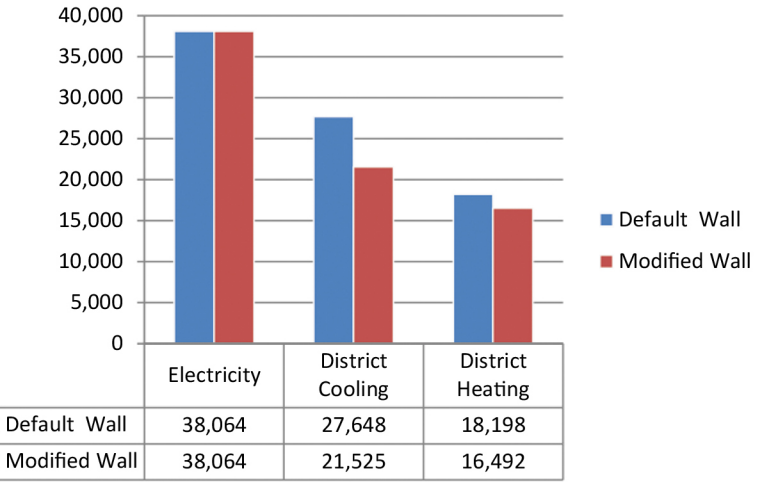
CONCLUSIONS

After run the simulating for every city we got the result to overview the energy consumption of the building and get a general view of our energy usage. after this step we try to modify our wall to see the difference in energy usage of the building. By increasing the thickness of the concrete and our insulation we tried to see the how this change affecting our general usage of energy.
By city of Shiraz and Tabriz we see that our usage is decreasing and we get a better performance of the building in the case of heating and cooling. But in the case of Bandar Abbas we see that the energy usage is more so **we understand that any city require its own consideration in the terms of building and construction.**

Annual Overview

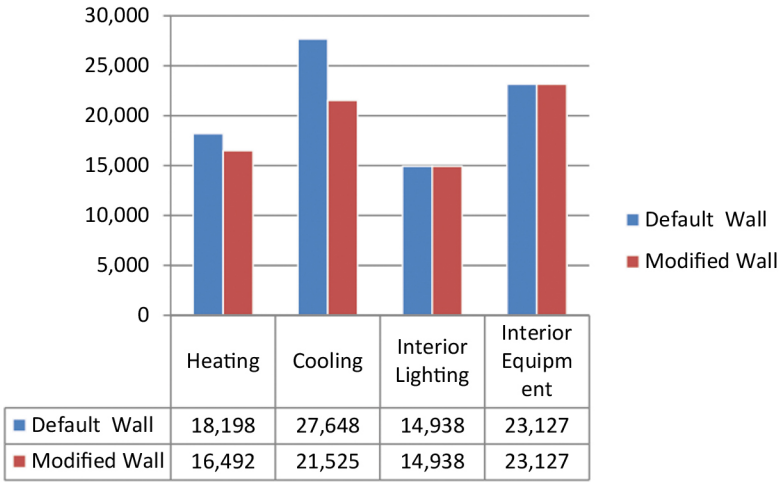
City: Shiraz

End Use Overview - Consumption (kBtu)



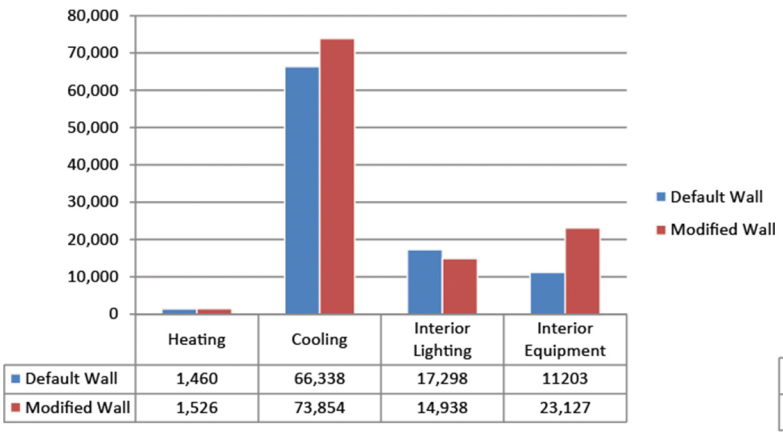
	Electricity	District Cooling	District Heating
Default Wall	38,064	27,648	18,198
Modified Wall	38,064	21,525	16,492

Energy Use Overview - Consumption (kBtu)

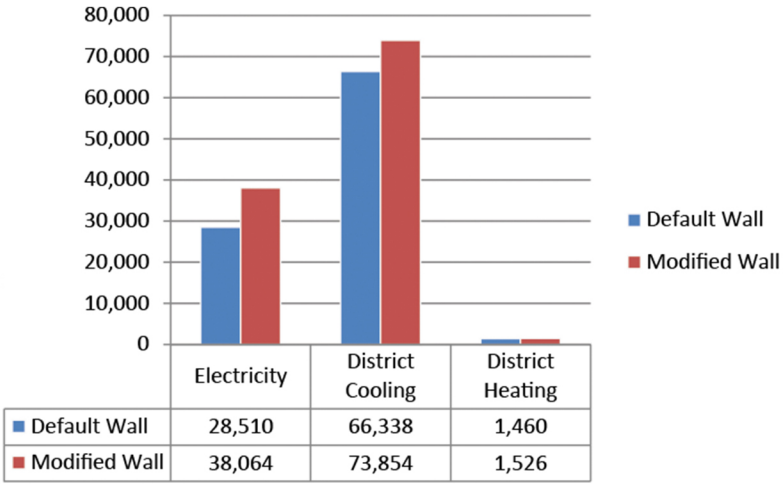


	Heating	Cooling	Interior Lighting	Interior Equipment
Default Wall	18,198	27,648	14,938	23,127
Modified Wall	16,492	21,525	14,938	23,127

City: Bandar Abbas

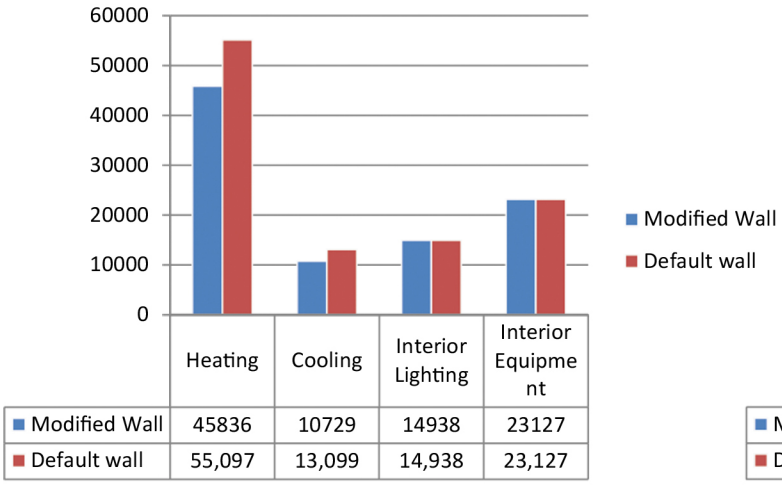


	Heating	Cooling	Interior Lighting	Interior Equipment
Default Wall	1,460	66,338	17,298	11203
Modified Wall	1,526	73,854	14,938	23,127

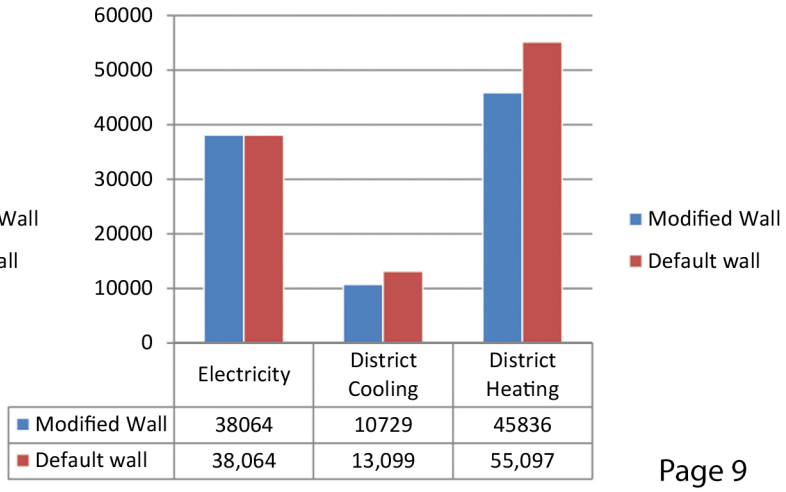


	Electricity	District Cooling	District Heating
Default Wall	28,510	66,338	1,460
Modified Wall	38,064	73,854	1,526

City: Tabriz



	Heating	Cooling	Interior Lighting	Interior Equipment
Modified Wall	45836	10729	14938	23127
Default wall	55,097	13,099	14,938	23,127



	Electricity	District Cooling	District Heating
Modified Wall	38064	10729	45836
Default wall	38,064	13,099	55,097