POLITECNICO
MILANO 1863

TES Project Commercial Building

Group W4

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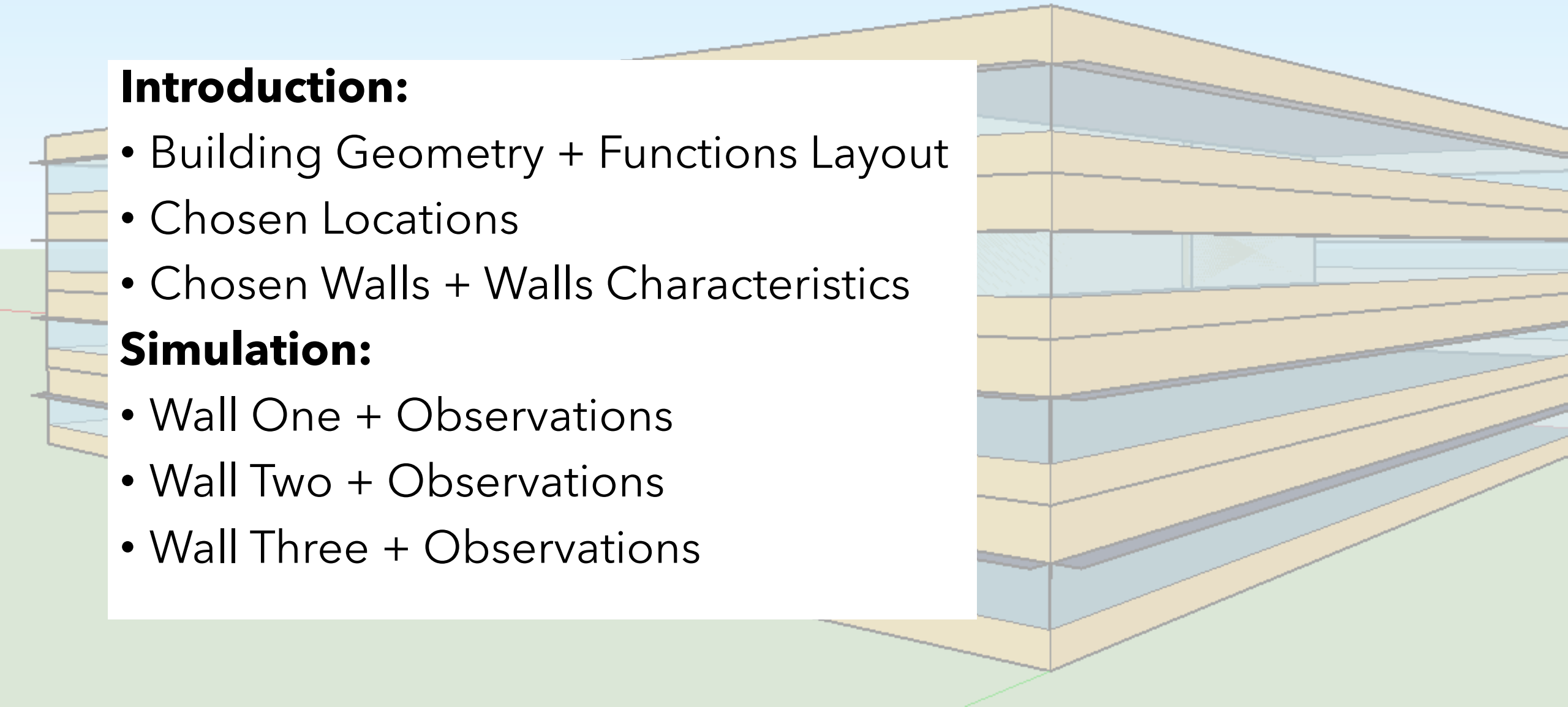
Outline



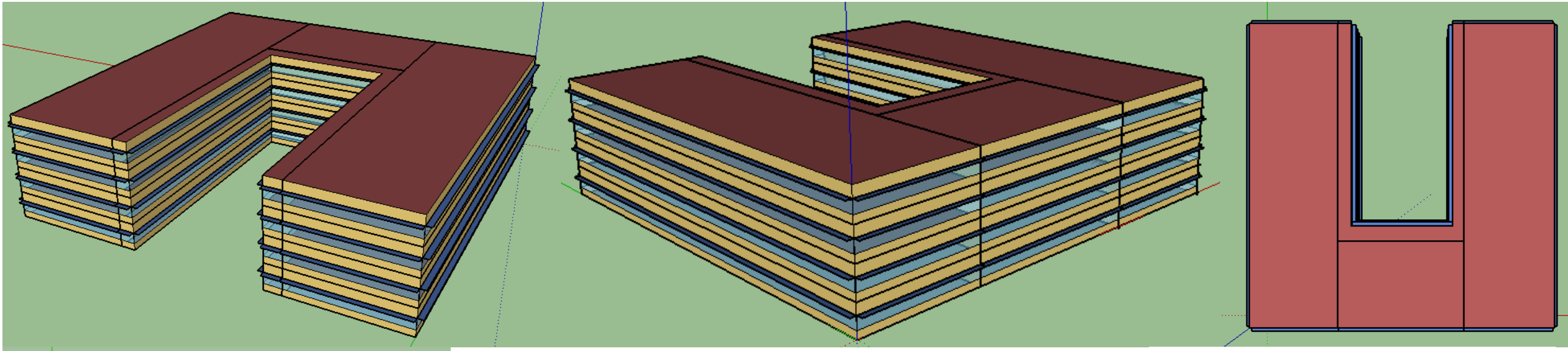
Introduction:

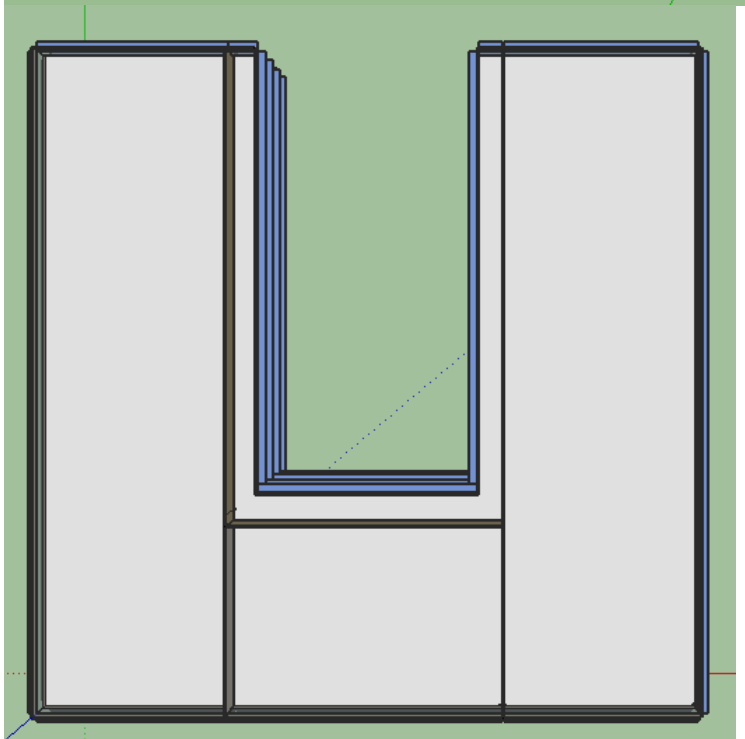
- Building Geometry + Functions Layout
- Chosen Locations
- Chosen Walls + Walls Characteristics

Simulation:

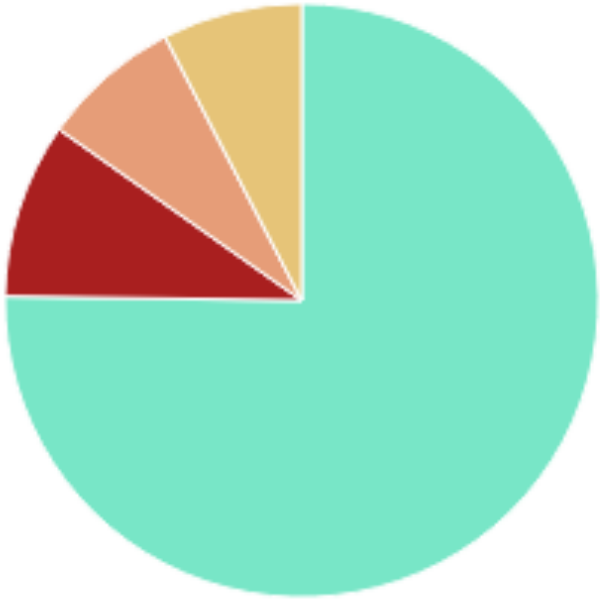
- Wall One + Observations
- Wall Two + Observations
- Wall Three + Observations

Commercial Building – Building Geometry





Number of Stories: 4
Base Case Location: Kuwait
Functions: Open offices, Conference Rooms, Break Rooms and Corridors.



Building Operations & Definitions

We proposed some parameters for our building where:

Operation Hours:

8 am till 3 pm – High Occupancy

3 pm till 7 pm – Low Occupancy – Shift Change

7 pm Till 4 am – High Occupancy

4 am till 8 am – Low Occupancy – Shift Change

Break Times:

1 pm till 2 pm

11 pm till 12 am

Lighting Loads:

Florescent lights 500 lumens per m2

8.3 Watts per m2

Occupancy Load: *(person/m2)*

Break Room : 0.5m2

Conference Room : 1.39m2

Open Office : 0.8m2

Corridor : 9.3m2

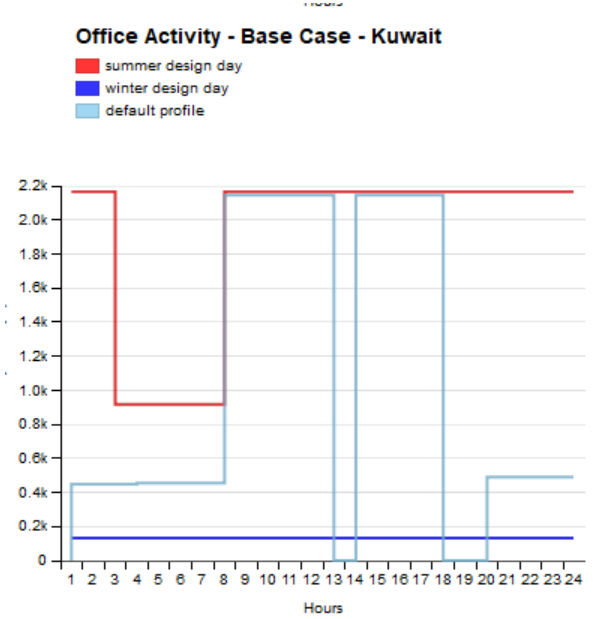
Radiation Loads: *(watts/person)*

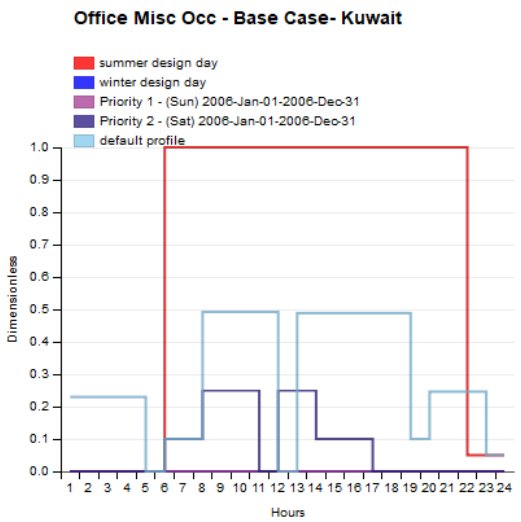
Kuwait– 2176 watts

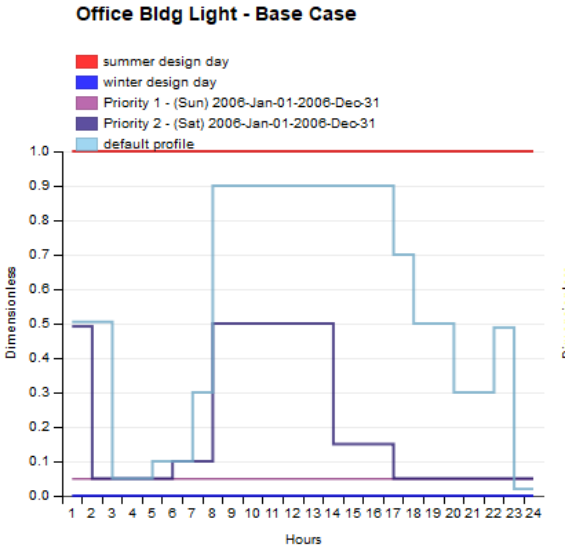
Russia – 854 watts

Sri lanka – 56 watts

Egypt – 172 watts



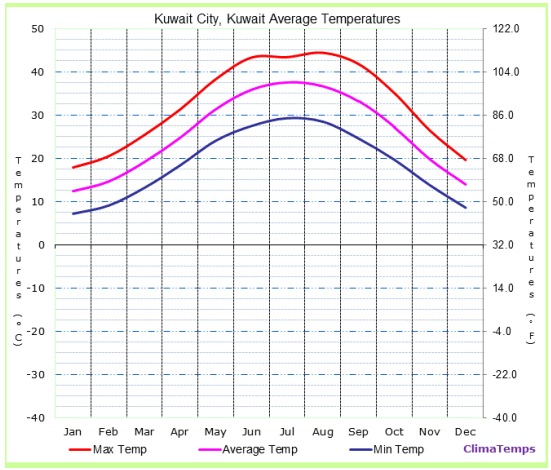




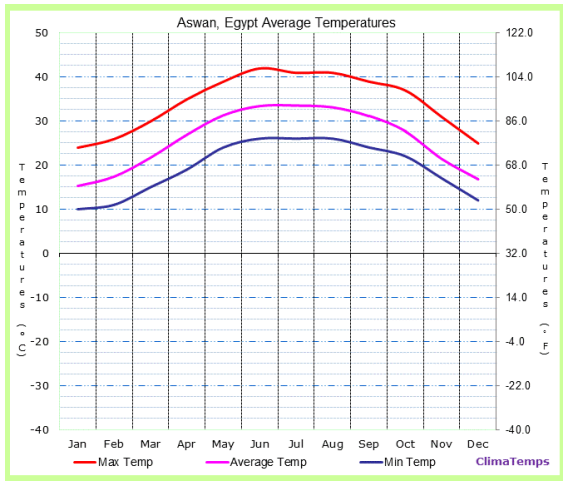
Chosen Locations

We chose 3 Different Locations + Base Case

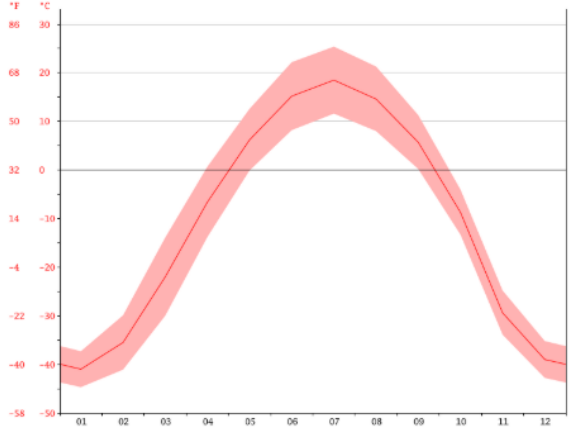
Hottest Location: Kuwait, Kuwait



Driest Location: Aswan, Egypt

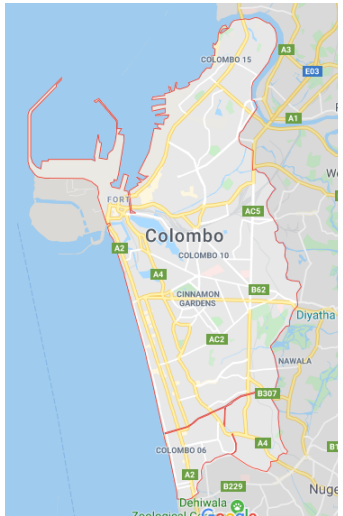


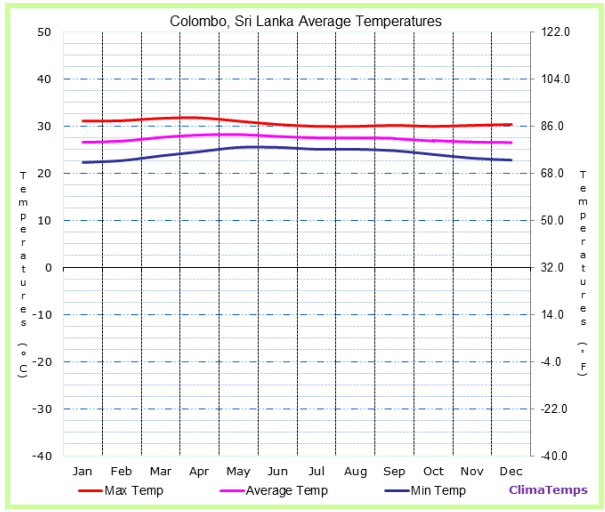
Coldest Location: Yakutsk , Russia



The warmest month of the year is July, with an average temperature of 18.5 °C. January has the lowest average temperature of the year. It is -41.0 °C.

Highest Humidity: Colombo, Sri Lanka

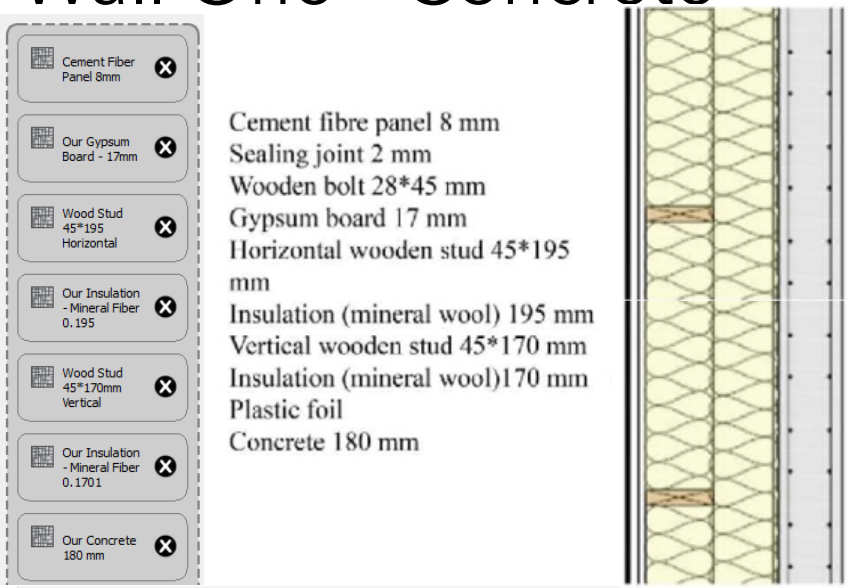




Chosen Walls & Characteristics

U-Value Calculated
1 m2.K/W = 5.678 hr-ft2-°F/Btu
We had to convert by multiplying by 5.678

Wall One – Concrete



Cement fibre panel 8 mm
Sealing joint 2 mm
Wooden bolt 28*45 mm
Gypsum board 17 mm
Horizontal wooden stud 45*195 mm
Insulation (mineral wool) 195 mm
Vertical wooden stud 45*170 mm
Insulation (mineral wool)170 mm
Plastic foil
Concrete 180 mm

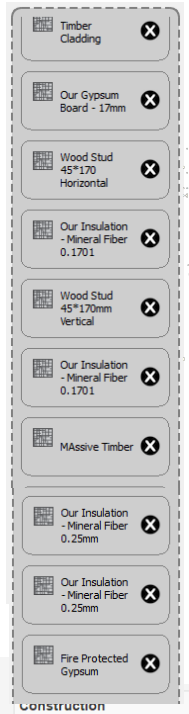
Construction	Net Area (ft^2)	Surface Count	R Value (ft^2*h*R/Btu)
ASHRAE 189.1-2009 ExtRoof IEAD ClimateZone 1	16,953	4	19.96
Wall One - Base Case	18,898	48	65.27

R = 65.27 = 11.49 K./watt

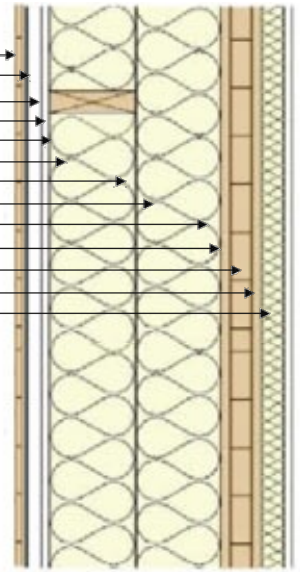
U = 0.087 $Q = \frac{\Delta T}{R} = \frac{293-263}{11.49} = 2.6\ W$

This wall type works best in Russia because the heat transfer is reduced through the walls. We don't need this type of wall in Colombo because the temperature there is moderate and the insulation will be useless.

Wall Two – Wood



Wooden Panels 12mm
Sealing Joint 2mm
Vertical wooden bolt 28*95mm
Gypsum board 17mm
Horizontal wooden stud 45*170mm
Insulation (mineral wool) 170mm
Vertical wooden stud 45*170mm
Insulation (mineral wool) 170mm
Plastic foil
Massive timber
Vertical wooden bolt 45*45mm
Insulation (mineral wool) 45mm
Gypsum board, fire protective



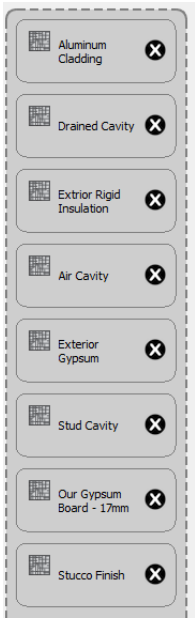
Construction	Net Area (ft^2)	Surface Count	R Value (ft^2*h*R/Btu)
ASHRAE 189.1-2009 ExtRoof Metal ClimateZone 6	16,953	4	30.48
Wall Two - Aswan	18,898	48	69.50

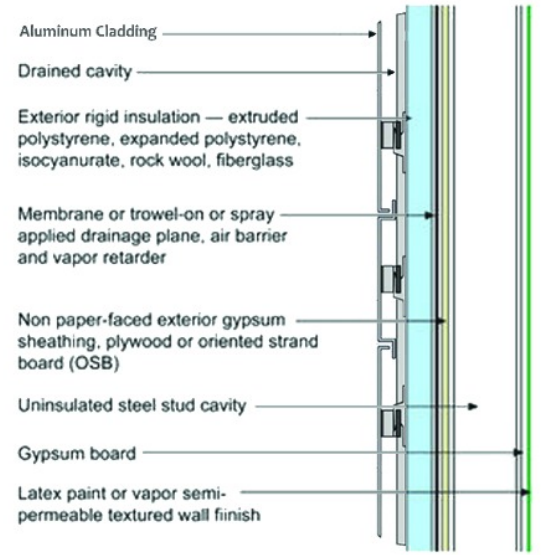
R = 69.50 = 12.24 K / watt

U = 0.082 $Q = \frac{\Delta T}{R} = \frac{293-263}{12.24} = 2.45\ W$

It works best in Aswan and Kuwait because the heat transfer is reduced through the walls. Even though the heat transfers through wood and bearing walls are nearly the same, the wood load bearing wall cannot be used in humid locations (ex. Russia)

Wall Three – Metal



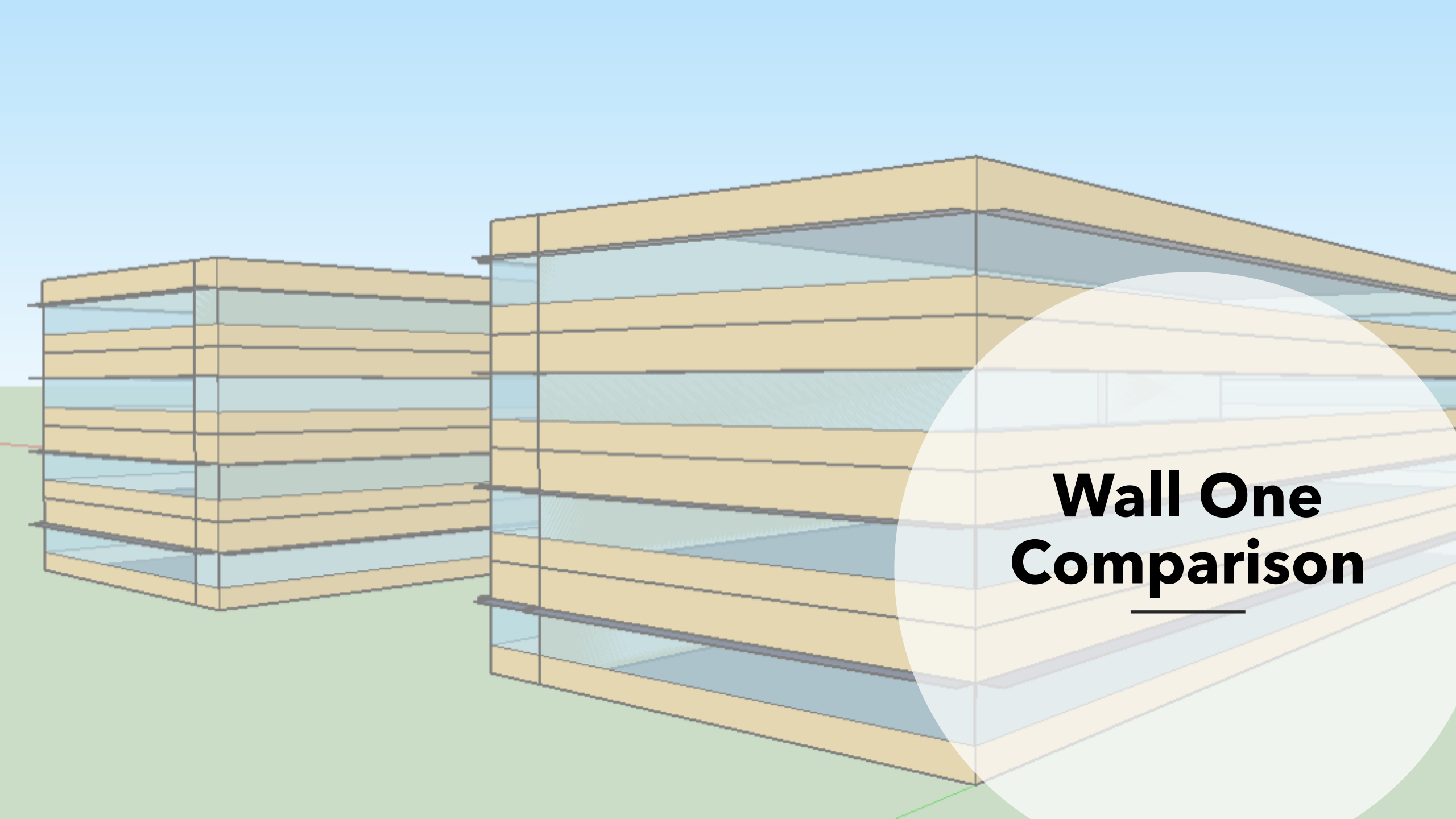


Construction	Net Area (ft^2)	Surface Count	R Value (ft^2*h*R/Btu)
ASHRAE 189.1-2009 ExtRoof IEAD ClimateZone 1	16,953	4	19.96
Wall Three	18,898	48	25.43

R = 25.43 = 4.48 K / watt

U = 0.22 $Q = \frac{\Delta T}{R} = \frac{293-263}{4.48} = 6.7\ W$

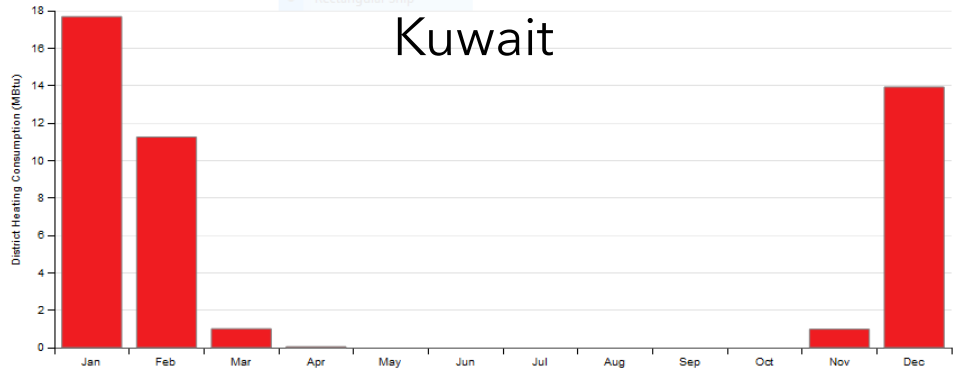
This wall works in Colombo because the outdoor temperature is 26 C which is good.
To make it work better in other locations, the steel stud cavity should be insulated.

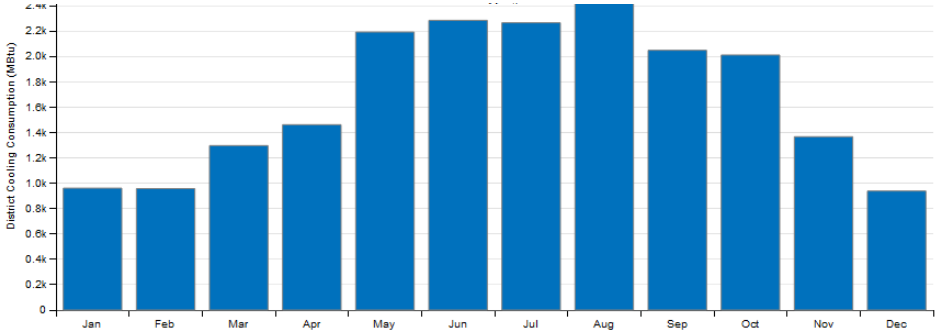


Wall One Comparison

Observations

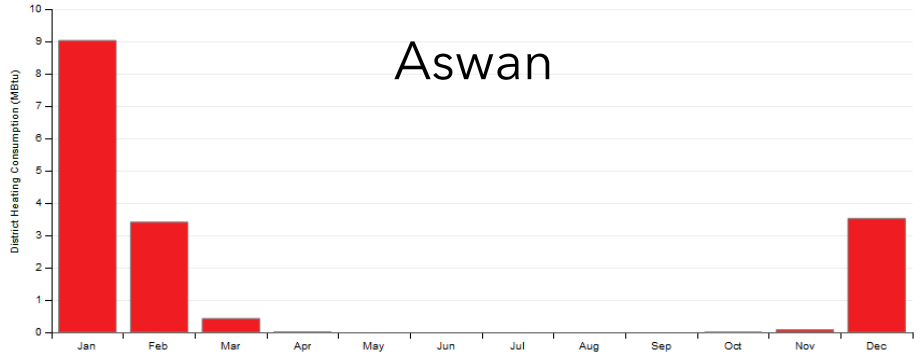
Kuwait

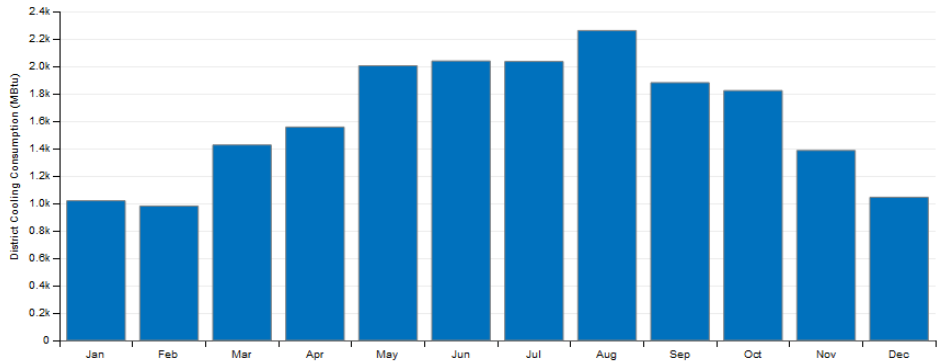




The wall is not so effective in Kuwait and Aswan due to the drastically hot weather there, so it's recommended to increase the thermal resistance of the wall by increasing the thermal thickness of the insulation wool.

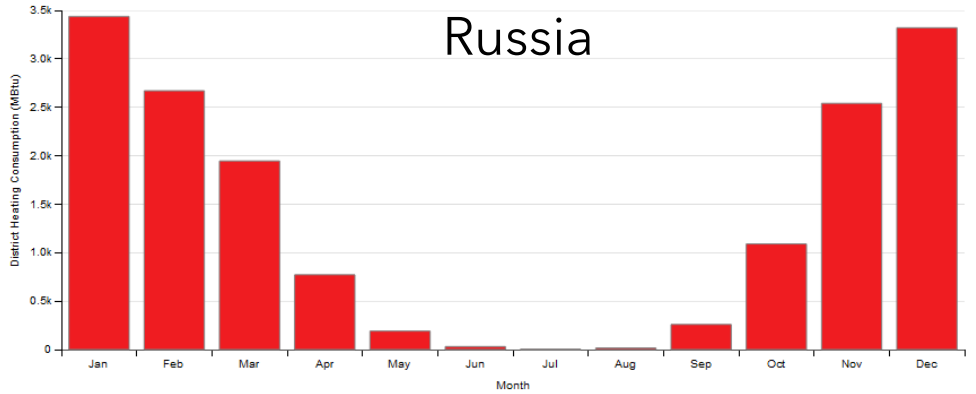
Aswan

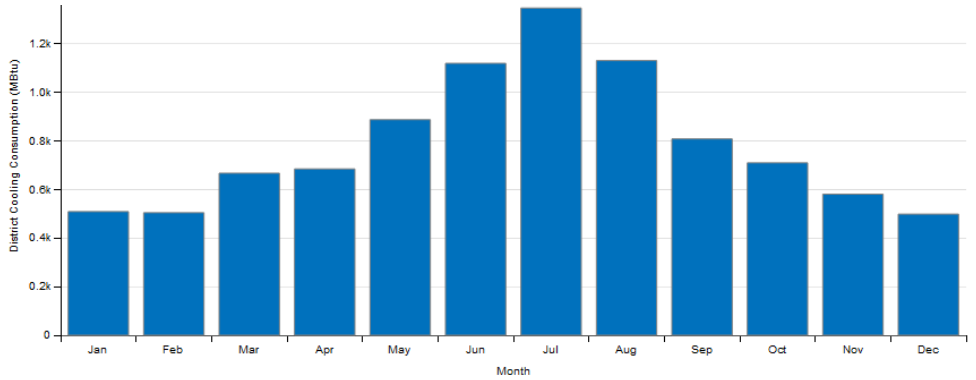




The wall is not needed in Colombo due to the moderate weather there, so no need for the high thermal resistance.

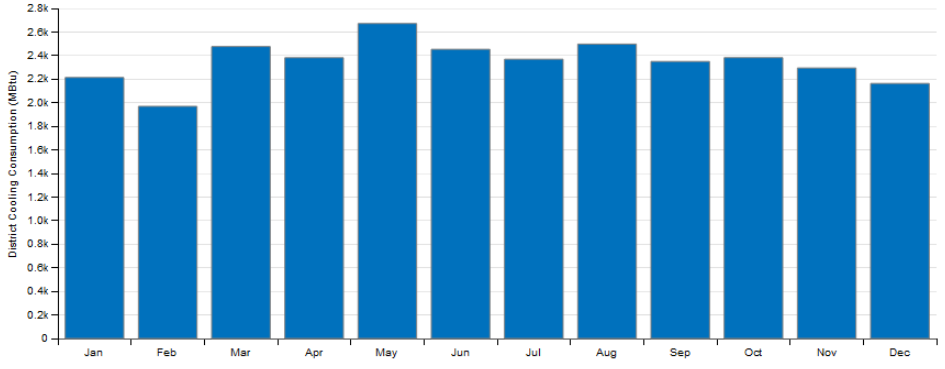
Russia





Colombo

No Heating Consumption for Colombo

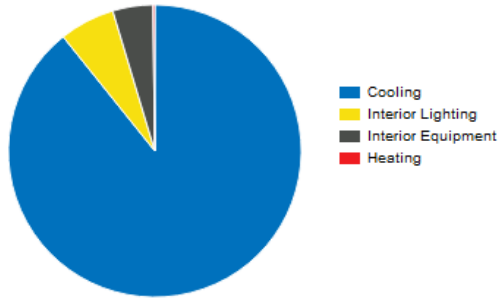


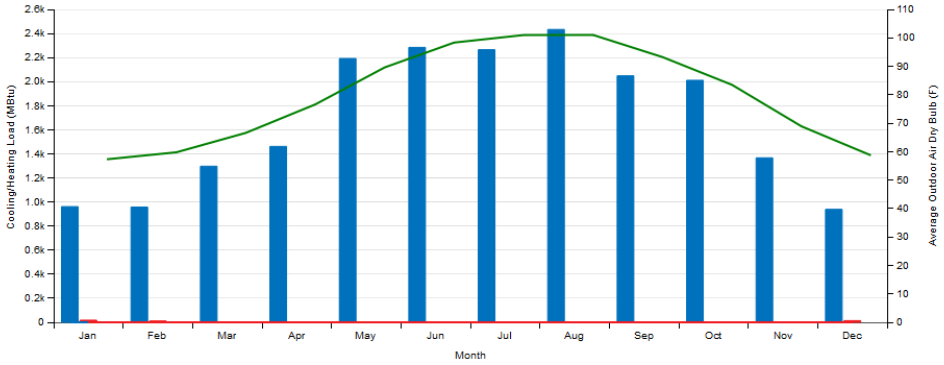
Observations

Kuwait

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	6.12
Space Heating	0.20
Space Cooling	89.25
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	4.44
Miscellaneous	-0.00



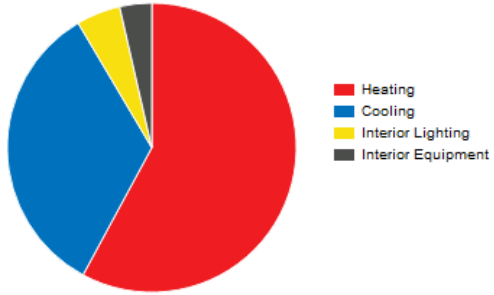


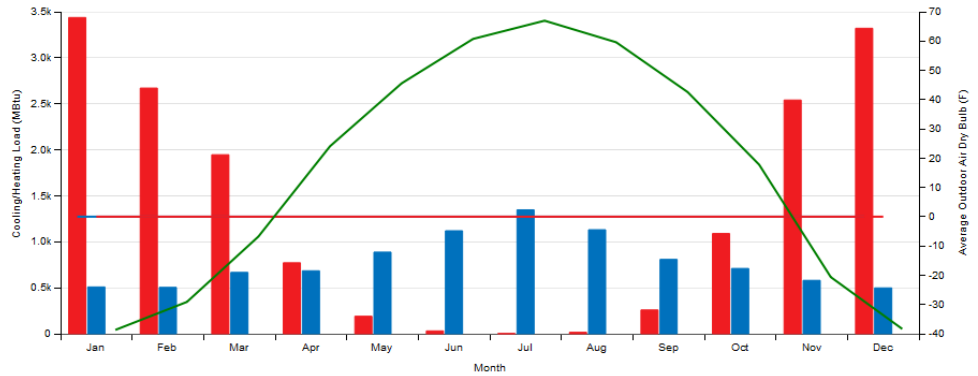
End use percentage is low or moderate in Russia due to the effective thermal resistance of the wall to the cold Weather there.

Russia

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	4.93
Space Heating	57.89
Space Cooling	33.61
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	3.57
Miscellaneous	-0.00



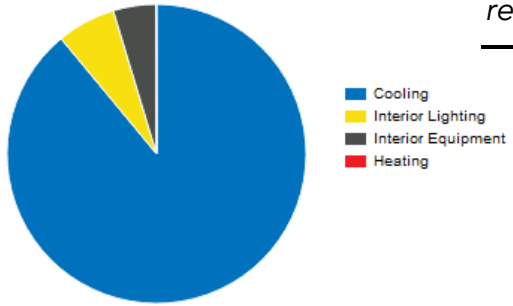


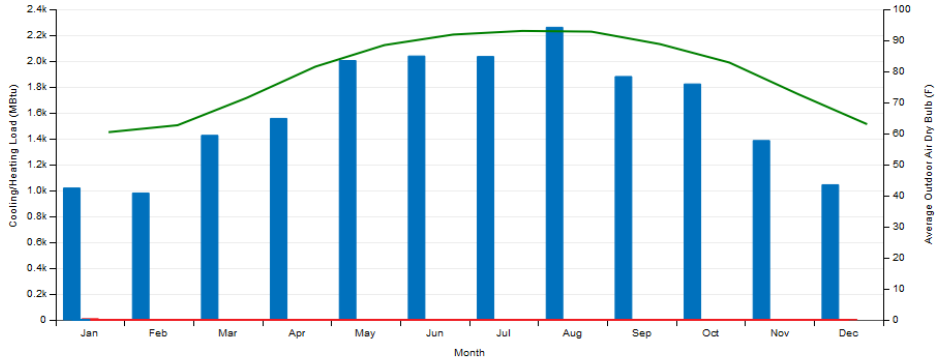
End use in Kuwait and Aswan cities are high compared to Russia and Colombo due to the hot climate there which needs a more effective wall with higher thermal resistance.

Aswan

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	6.34
Space Heating	0.08
Space Cooling	88.99
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	4.60
Miscellaneous	-0.00



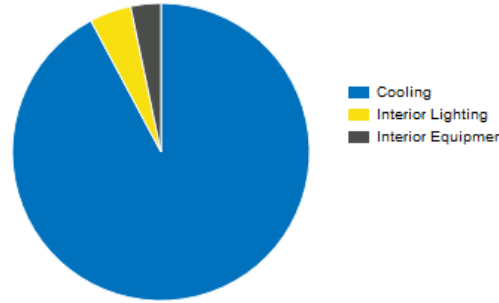


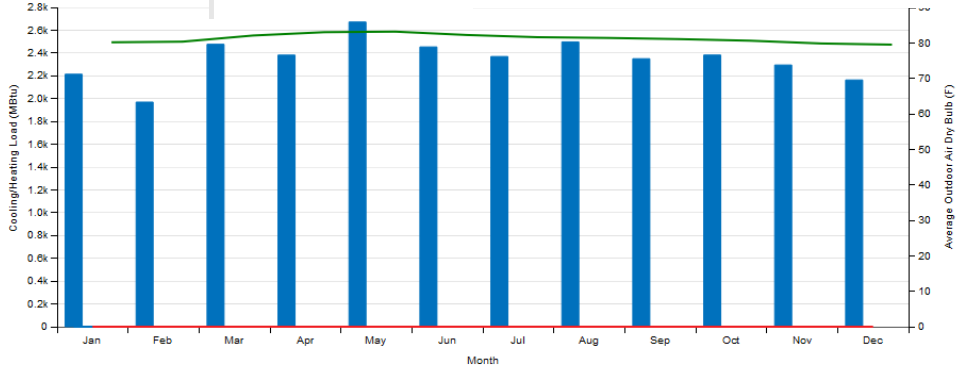
End use in Colombo is high due to the very high humidity there which can't be resisted by the wall material. So the wall is not effective.

Colombo

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	4.53
Space Heating	0.00
Space Cooling	92.19
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	3.28
Miscellaneous	-0.00





Wall One – Russia

EAp2-6. Energy Use Summary

	Process Subtotal [GJ]	Total Energy Use [GJ]
Electricity	1060.26	2522.39
Natural Gas	0.00	0.00
Additional	0.00	27145.95
Total	1060.26	29668.34

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	29668.34	4709.26	4709.26
Net Site Energy	29668.34	4709.26	4709.26
Total Source Energy	80572.52	12789.29	12789.29
Net Source Energy	80572.52	12789.29	12789.29

Wall One – Colombo

EAp2-6. Energy Use Summary

	Process Subtotal [GJ]	Total Energy Use [GJ]
Electricity	1060.26	2522.39
Natural Gas	0.00	0.00
Additional	0.00	29777.81
Total	1060.26	32300.20

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	32300.20	5127.02	5127.02
Net Site Energy	32300.20	5127.02	5127.02
Total Source Energy	39423.86	6257.76	6257.76
Net Source Energy	39423.86	6257.76	6257.76

Wall One – Aswan

EAp2-6. Energy Use Summary

	Process Subtotal [GJ]	Total Energy Use [GJ]
Electricity	1060.26	2522.39
Natural Gas	0.00	0.00
Additional	0.00	20542.79
Total	1060.26	23065.18

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	23065.18	3661.14	3661.14
Net Site Energy	23065.18	3661.14	3661.14
Total Source Energy	29719.20	4717.33	4717.33
Net Source Energy	29719.20	4717.33	4717.33

Wall One – Kuwait

EAp2-6. Energy Use Summary

	Process Subtotal [GJ]	Total Energy Use [GJ]
Electricity	1060.26	2522.39
Natural Gas	0.00	0.00
Additional	0.00	22250.42
Total	1060.26	24772.81

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	24772.81	3932.19	3932.19
Net Site Energy	24772.81	3932.19	3932.19
Total Source Energy	31543.26	5006.87	5006.87
Net Source Energy	31543.26	5006.87	5006.87

Utility Use & Loads - Wall One

Kuwait

Utility Use Per Conditioned Floor Area

	Electricity Intensity [MJ/m2]	Natural Gas Intensity [MJ/m2]	Additional Fuel Intensity [MJ/m2]	District Cooling Intensity [MJ/m2]	District Heating Intensity [MJ/m2]	Water Intensity [m3/m2]
Lighting	232.08	0.00	0.00	0.00	0.00	0.00
HVAC	0.00	0.00	0.00	3529.31	5.13	0.00
Other	168.29	0.00	0.00	0.00	0.00	0.00
Total	400.38	0.00	0.00	3529.31	5.13	0.00

Aswan

Utility Use Per Conditioned Floor Area

	Electricity Intensity [MJ/m2]	Natural Gas Intensity [MJ/m2]	Additional Fuel Intensity [MJ/m2]	District Cooling Intensity [MJ/m2]	District Heating Intensity [MJ/m2]	Water Intensity [m3/m2]
Lighting	232.08	0.00	0.00	0.00	0.00	0.00
HVAC	0.00	0.00	0.00	3417.47	1.72	0.00
Other	168.29	0.00	0.00	0.00	0.00	0.00
Total	400.38	0.00	0.00	3417.47	1.72	0.00

Colombo

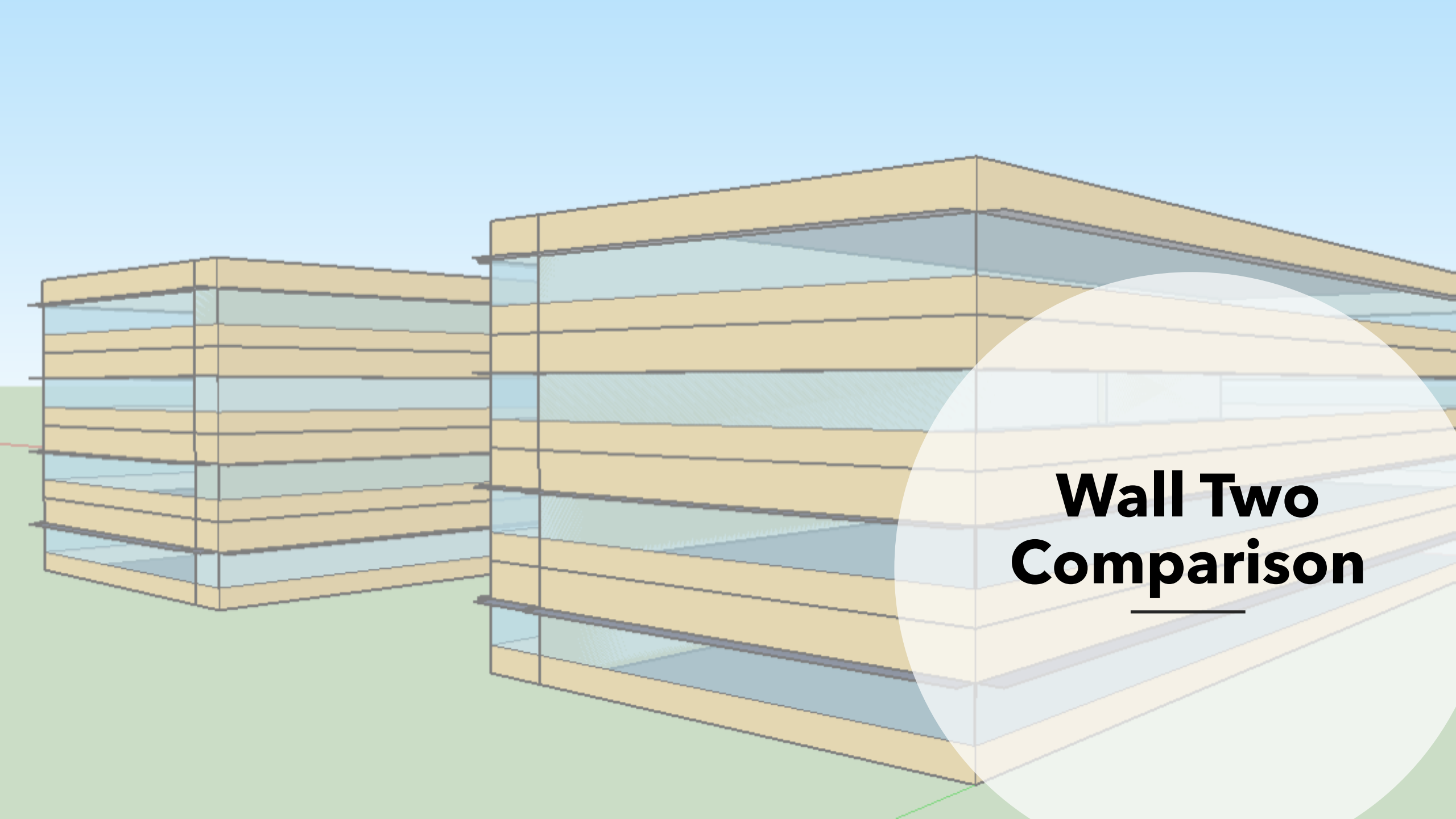
Utility Use Per Conditioned Floor Area

	Electricity Intensity [MJ/m2]	Natural Gas Intensity [MJ/m2]	Additional Fuel Intensity [MJ/m2]	District Cooling Intensity [MJ/m2]	District Heating Intensity [MJ/m2]	Water Intensity [m3/m2]
Lighting	232.08	0.00	0.00	0.00	0.00	0.00
HVAC	0.00	0.00	0.00	4910.41	0.00	0.00
Other	168.29	0.00	0.00	0.00	0.00	0.00
Total	400.38	0.00	0.00	4910.41	0.00	0.00

Russia

Utility Use Per Conditioned Floor Area

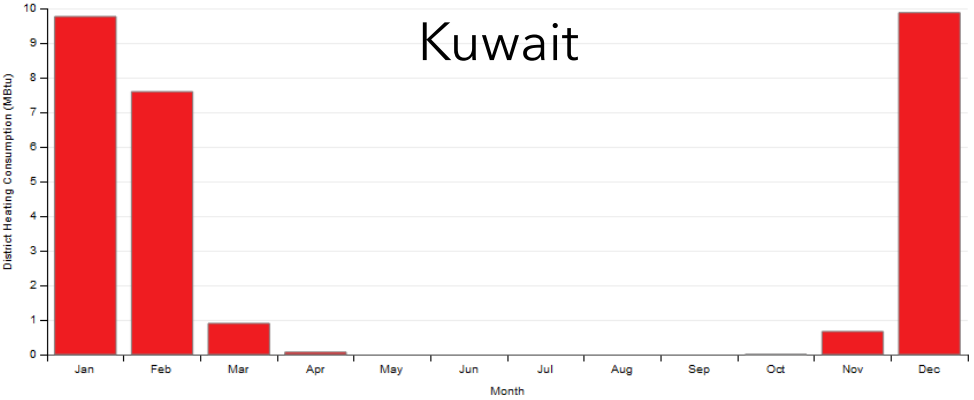
	Electricity Intensity [MJ/m2]	Natural Gas Intensity [MJ/m2]	Additional Fuel Intensity [MJ/m2]	District Cooling Intensity [MJ/m2]	District Heating Intensity [MJ/m2]	Water Intensity [m3/m2]
Lighting	232.08	0.00	0.00	0.00	0.00	0.00
HVAC	0.00	0.00	0.00	1650.73	2632.15	0.00
Other	168.29	0.00	0.00	0.00	0.00	0.00
Total	400.38	0.00	0.00	1650.73	2632.15	0.00

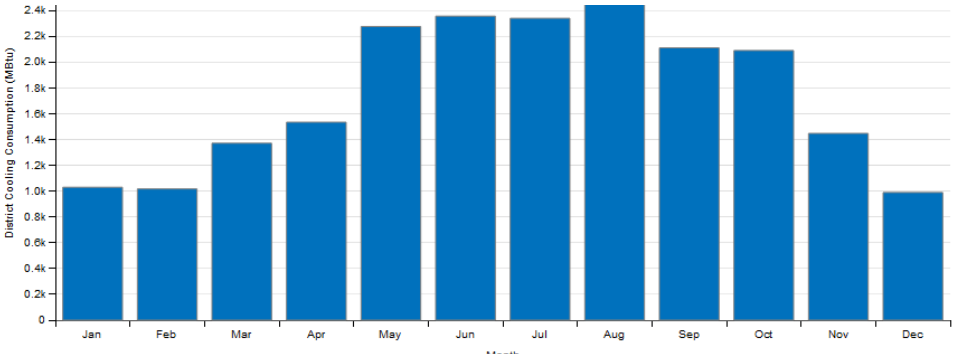


Wall Two Comparison

Observations

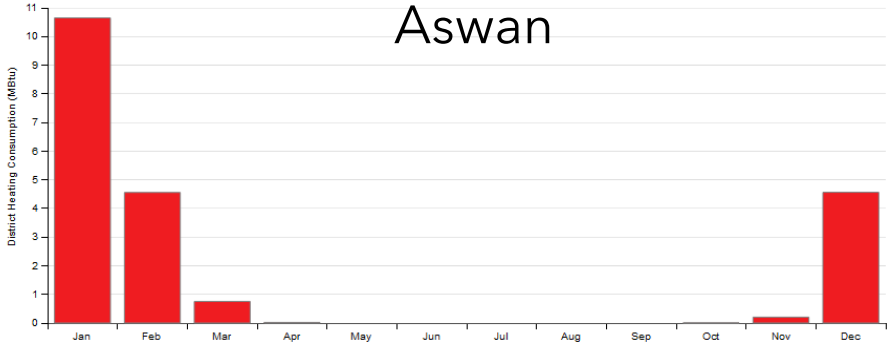
Kuwait

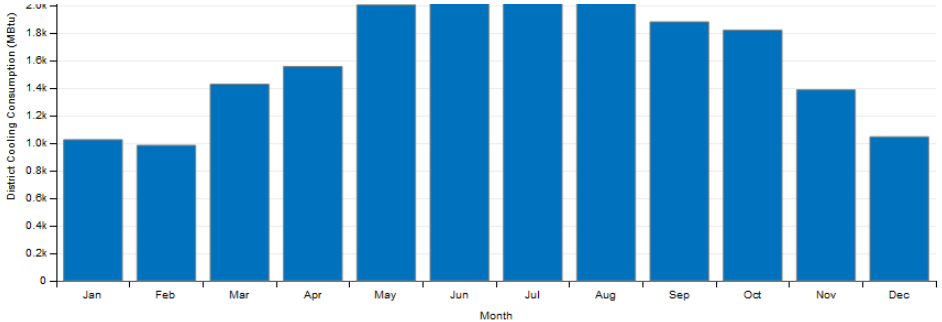




The wall is so effective in Kuwait and Aswan due to it's high thermal resistance, as well as wood material is suitable for dry areas where it saves the interior cool climate.

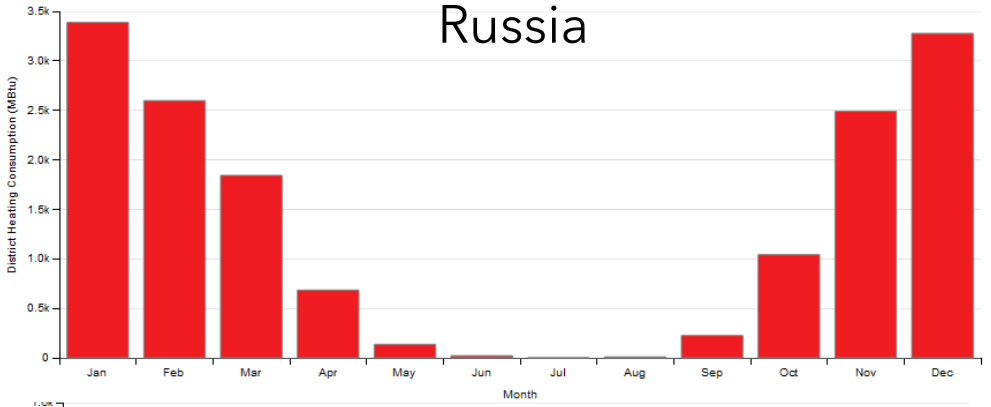
Aswan



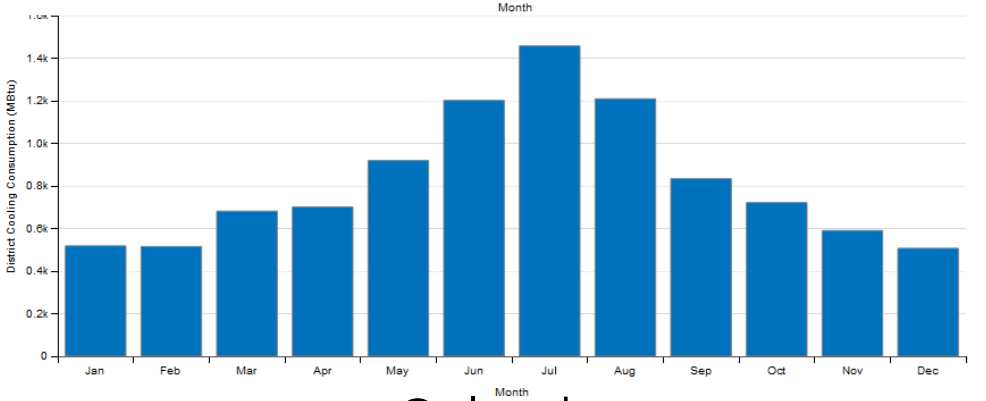


The wall is not suitable for Colombo because it's made wood which is not suitable for humid areas as well as the high thermal resistance which is not needed for Colombo's moderate weather.

Russia

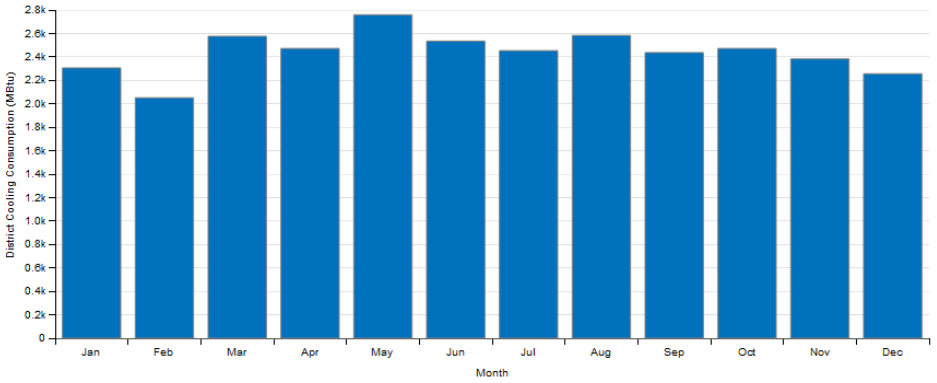


The wall is effective in Russia as for thermal resistance but it's not recommended as the wood is not suitable in humid areas.



Colombo

No Heating Consumption for Colombo

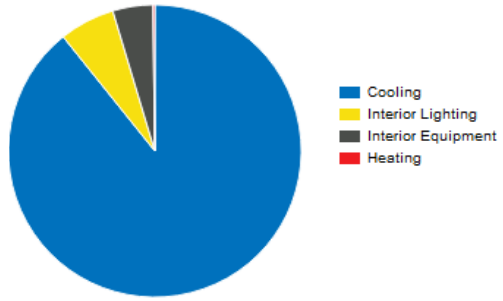


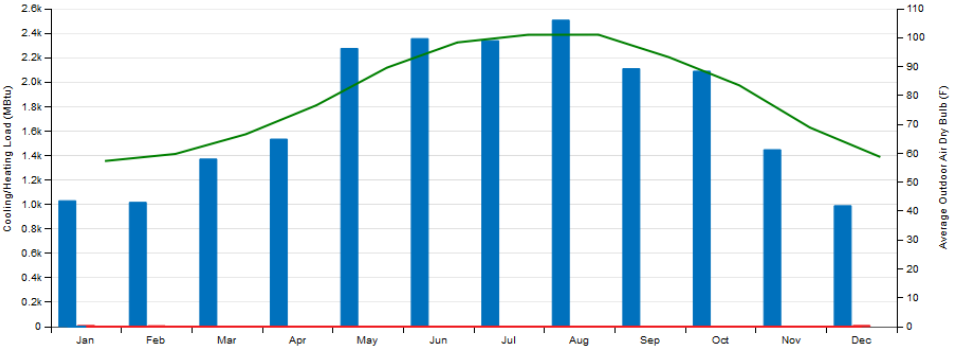
Observations

Kuwait

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	5.90
Space Heating	0.12
Space Cooling	89.70
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	4.28
Miscellaneous	-0.00



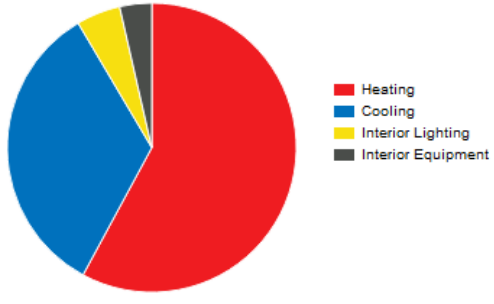


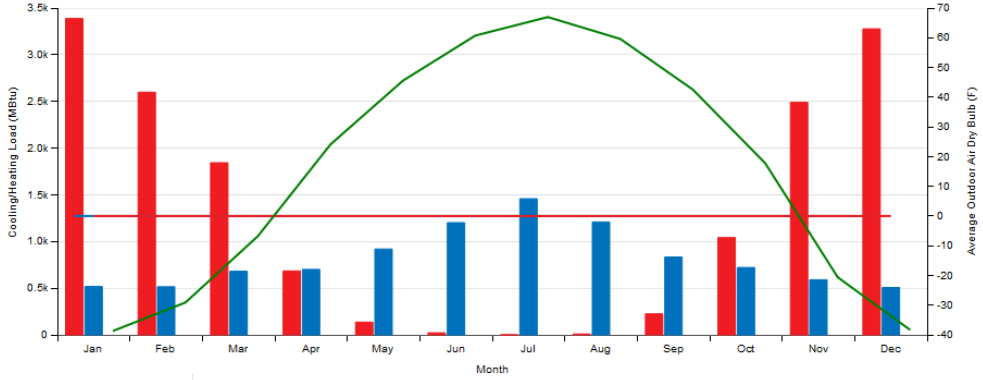
End use percentage is low or moderate in Russia due to the effective thermal resistance of the wall to the cold Weather there.

Russia

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	4.96
Space Heating	56.20
Space Cooling	35.25
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	3.59
Miscellaneous	-0.00



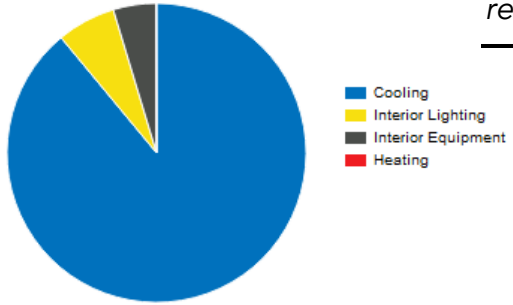


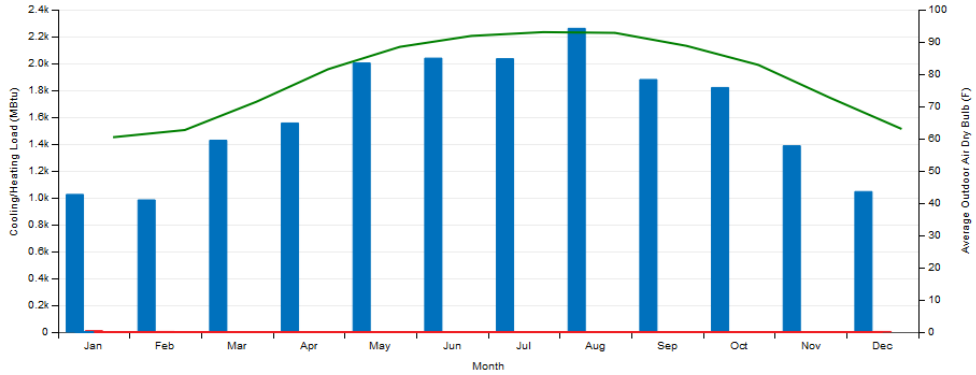
End use in Kuwait and Aswan cities are high compared to Russia and Colombo due to the hot climate there which needs a more effective wall with higher thermal resistance.

Aswan

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	6.33
Space Heating	0.09
Space Cooling	88.98
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	4.59
Miscellaneous	-0.00



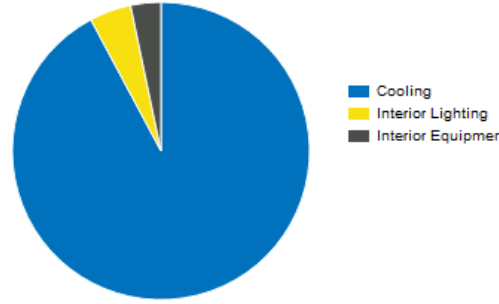


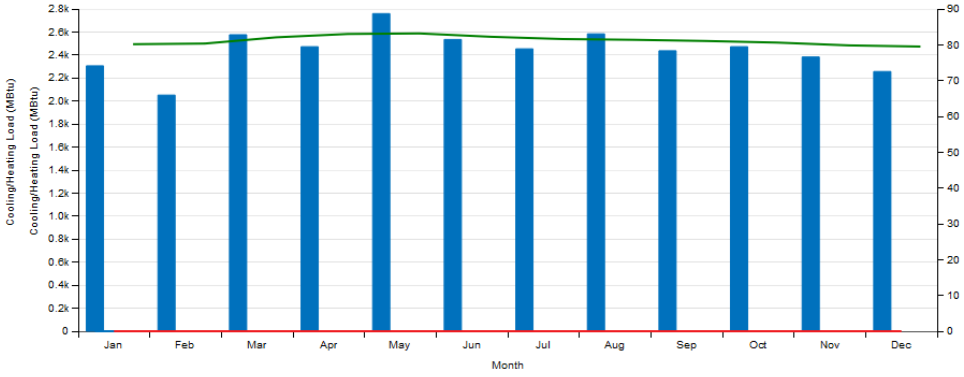
End use in Colombo is high due to the very high humidity there which can't be resisted by the wall material. So the wall is not effective.

Colombo

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	4.37
Space Heating	0.00
Space Cooling	92.45
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	3.17
Miscellaneous	-0.00





Wall Two – Kuwait

EAp2-6. Energy Use Summary

	Process Subtotal [GJ]	Total Energy Use [GJ]
Electricity	1060.26	2522.39
Natural Gas	0.00	0.00
Additional	0.00	22254.23
Total	1060.26	24776.63

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	24776.63	3932.80	3932.80
Net Site Energy	24776.63	3932.80	3932.80
Total Source Energy	31559.39	5009.43	5009.43
Net Source Energy	31559.39	5009.43	5009.43

Wall Two – Colombo

EAp2-6. Energy Use Summary

	Process Subtotal [GJ]	Total Energy Use [GJ]
Electricity	1060.26	2522.39
Natural Gas	0.00	0.00
Additional	0.00	30899.27
Total	1060.26	33421.66

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	33421.66	5305.03	5305.03
Net Site Energy	33421.66	5305.03	5305.03
Total Source Energy	40607.74	6445.67	6445.67
Net Source Energy	40607.74	6445.67	6445.67

Wall Two – Aswan

EAp2-6. Energy Use Summary

	Process Subtotal [GJ]	Total Energy Use [GJ]
Electricity	1060.26	2522.39
Natural Gas	0.00	0.00
Additional	0.00	20559.56
Total	1060.26	23081.95

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	23081.95	3663.80	3663.80
Net Site Energy	23081.95	3663.80	3663.80
Total Source Energy	29748.46	4721.98	4721.98
Net Source Energy	29748.46	4721.98	4721.98

Wall Two – Russia

EAp2-6. Energy Use Summary

	Process Subtotal [GJ]	Total Energy Use [GJ]
Electricity	1060.26	2522.39
Natural Gas	0.00	0.00
Additional	0.00	26982.14
Total	1060.26	29504.53

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	29504.53	4683.26	4683.26
Net Site Energy	29504.53	4683.26	4683.26
Total Source Energy	78885.19	12521.46	12521.46
Net Source Energy	78885.19	12521.46	12521.46

Utility Use & Loads - Wall Two

Kuwait

Utility Use Per Conditioned Floor Area

	Electricity Intensity [MJ/m2]	Natural Gas Intensity [MJ/m2]	Additional Fuel Intensity [MJ/m2]	District Cooling Intensity [MJ/m2]	District Heating Intensity [MJ/m2]	Water Intensity [m3/m2]
Lighting	232.08	0.00	0.00	0.00	0.00	0.00
HVAC	0.00	0.00	0.00	3529.31	5.13	0.00
Other	168.29	0.00	0.00	0.00	0.00	0.00
Total	400.38	0.00	0.00	3529.31	5.13	0.00

Aswan

Utility Use Per Conditioned Floor Area

	Electricity Intensity [MJ/m2]	Natural Gas Intensity [MJ/m2]	Additional Fuel Intensity [MJ/m2]	District Cooling Intensity [MJ/m2]	District Heating Intensity [MJ/m2]	Water Intensity [m3/m2]
Lighting	232.08	0.00	0.00	0.00	0.00	0.00
HVAC	0.00	0.00	0.00	3417.47	1.72	0.00
Other	168.29	0.00	0.00	0.00	0.00	0.00
Total	400.38	0.00	0.00	3417.47	1.72	0.00

Colombo

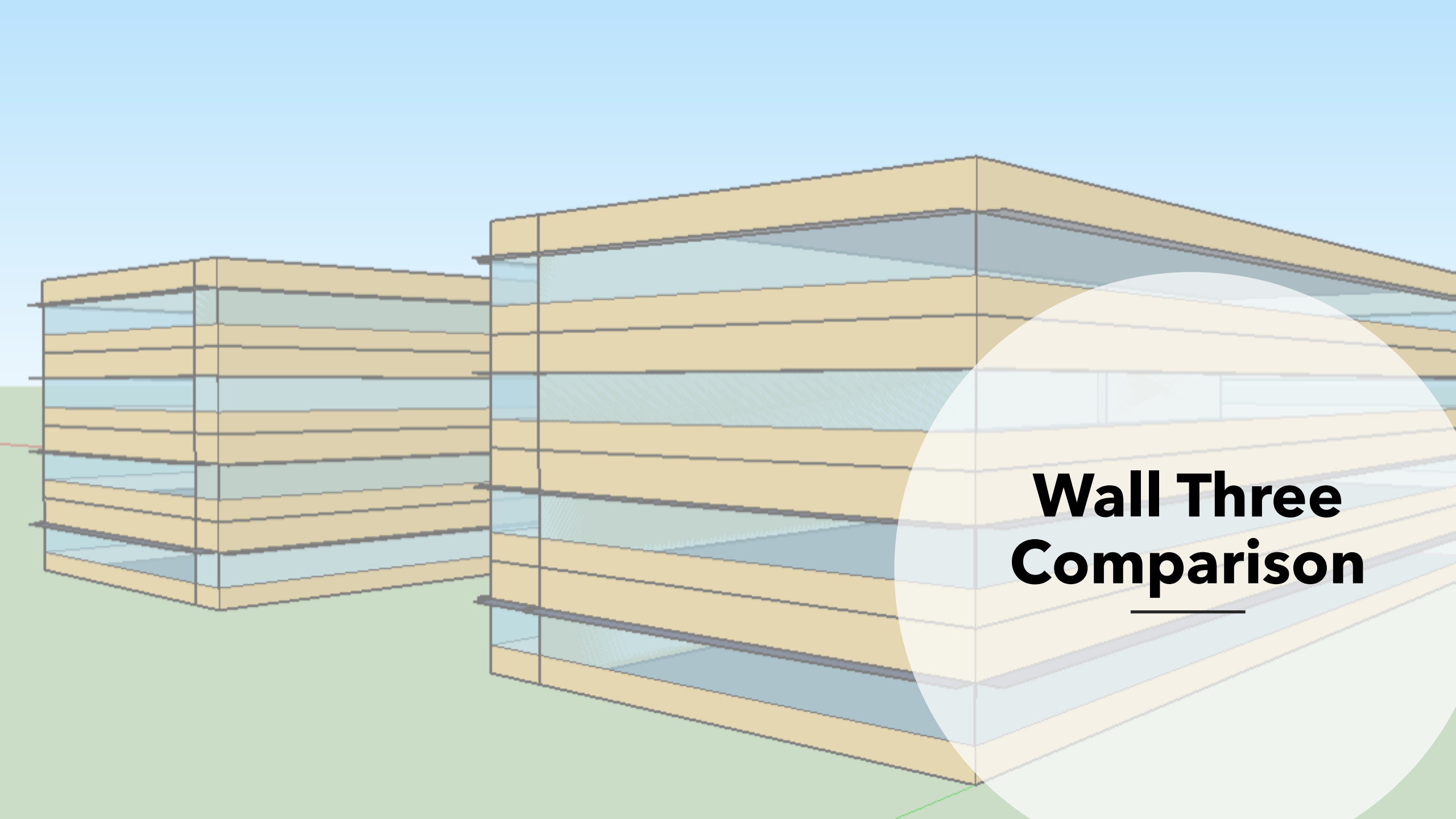
Utility Use Per Conditioned Floor Area

	Electricity Intensity [MJ/m2]	Natural Gas Intensity [MJ/m2]	Additional Fuel Intensity [MJ/m2]	District Cooling Intensity [MJ/m2]	District Heating Intensity [MJ/m2]	Water Intensity [m3/m2]
Lighting	232.08	0.00	0.00	0.00	0.00	0.00
HVAC	0.00	0.00	0.00	4904.65	0.00	0.00
Other	168.29	0.00	0.00	0.00	0.00	0.00
Total	400.38	0.00	0.00	4904.65	0.00	0.00

Russia

Utility Use Per Conditioned Floor Area

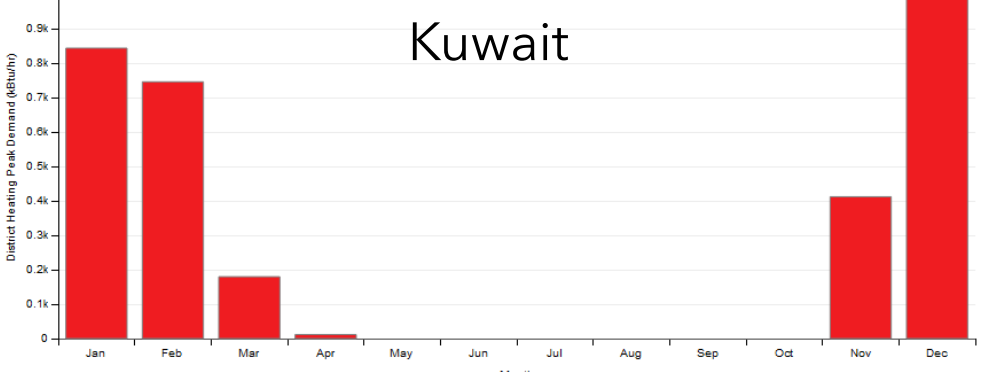
	Electricity Intensity [MJ/m2]	Natural Gas Intensity [MJ/m2]	Additional Fuel Intensity [MJ/m2]	District Cooling Intensity [MJ/m2]	District Heating Intensity [MJ/m2]	Water Intensity [m3/m2]
Lighting	232.08	0.00	0.00	0.00	0.00	0.00
HVAC	0.00	0.00	0.00	1650.73	2632.15	0.00
Other	168.29	0.00	0.00	0.00	0.00	0.00
Total	400.38	0.00	0.00	1650.73	2632.15	0.00

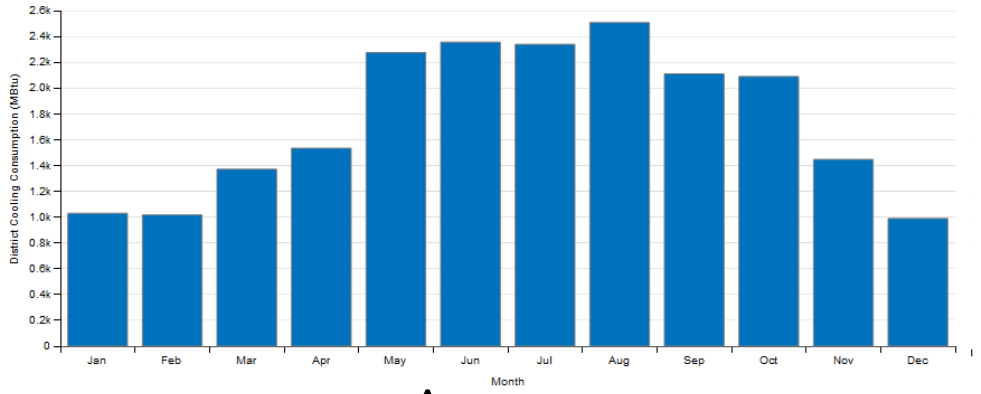


Wall Three Comparison

Observations

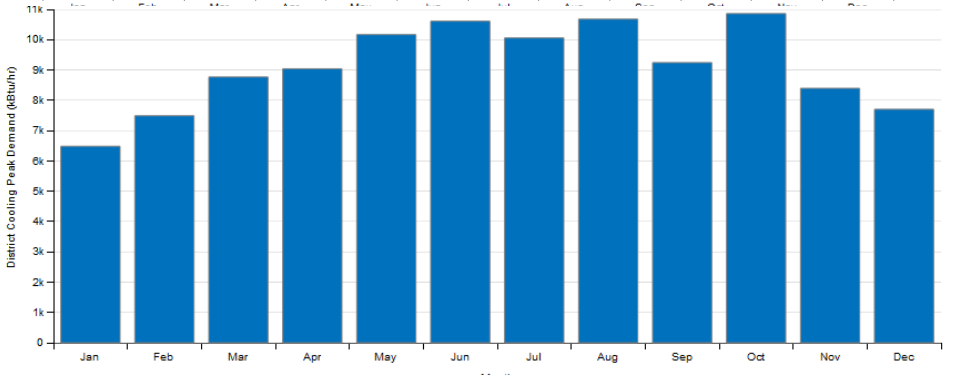
Kuwait





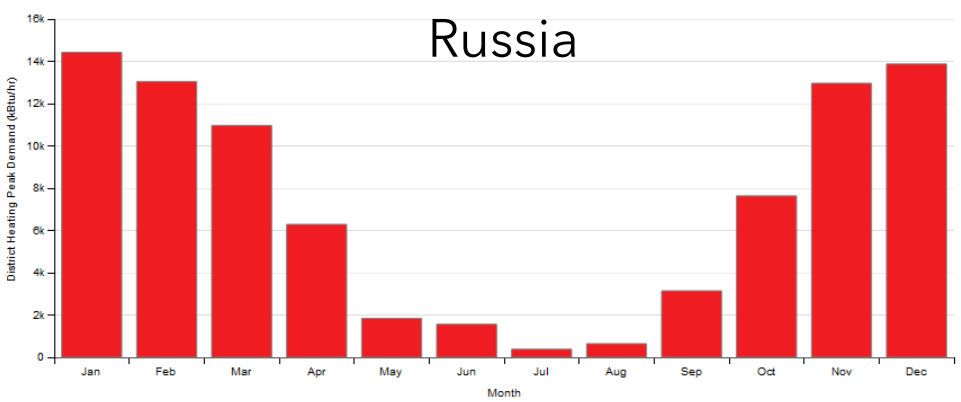
The wall is not effective in Kuwait and Aswan due to it's low thermal resistance. So it's recommended to use a higher thermal resistant material other than the aluminum.

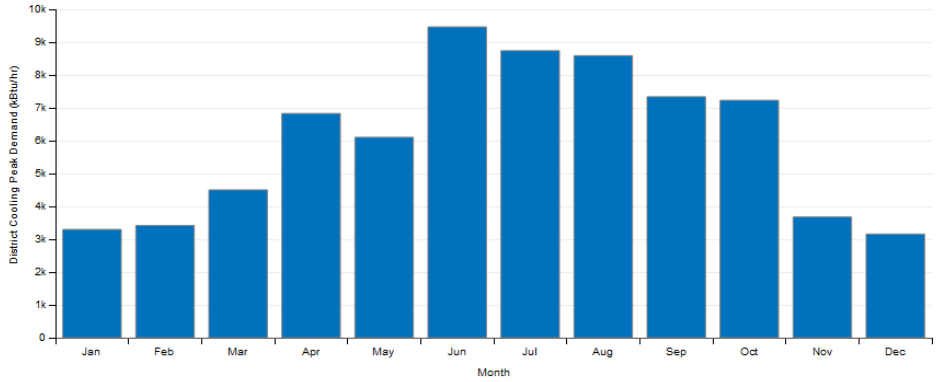
Aswan



The wall is not effective in Russia due to it's low thermal resistance as well as the aluminum material doesn't work good as a thermal resistor in cold climates due to it's high thermal conductivity.

Russia

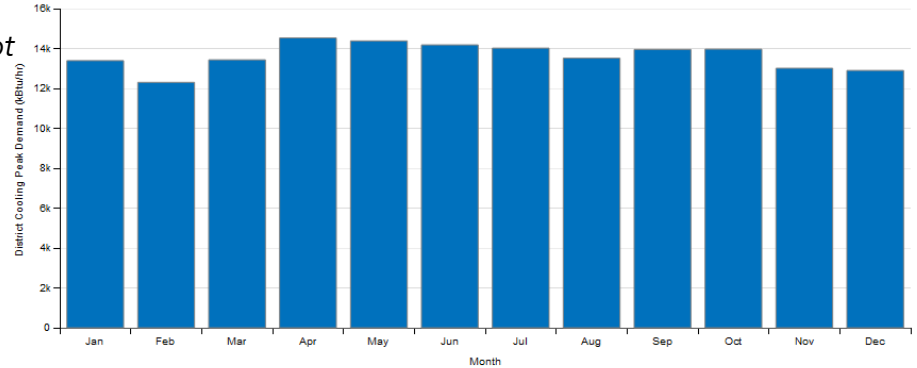




Colombo

No Heating Consumption for Colombo

The wall is suitable for Colombo's moderate weather as it doesn't need a high thermal resistance wall while it's not totally fine for humid areas as the aluminum material doesn't resist humidity. So it's recommended to use a wall with the same insulation and thickness while using a different outer material other than the aluminum for higher humidity resistance.

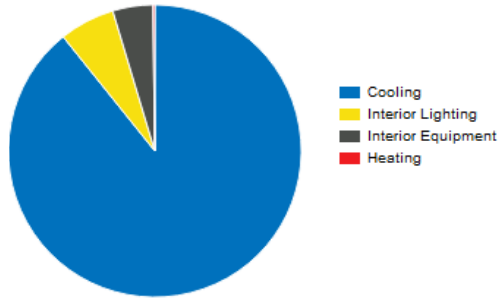


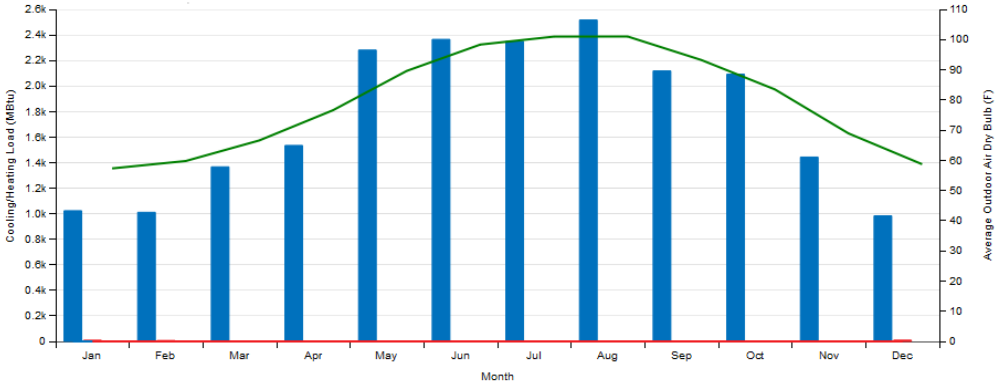
Observations

Kuwait

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	5.90
Space Heating	0.12
Space Cooling	89.71
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	4.28
Miscellaneous	-0.00



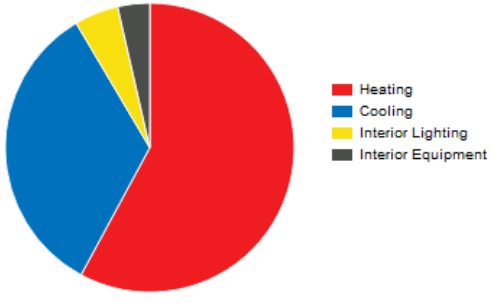


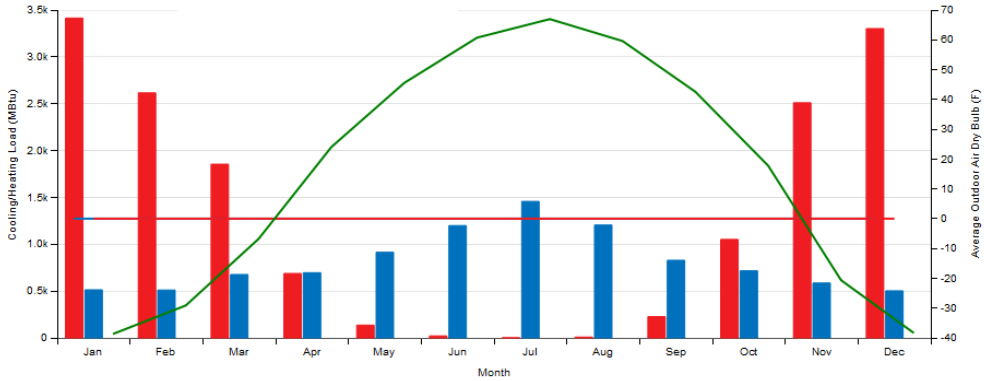
End use percentage is higher compared to other walls due to the higher thermal conductivity of the wall.

Russia

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	4.94
Space Heating	56.48
Space Cooling	34.99
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	3.59
Miscellaneous	-0.00



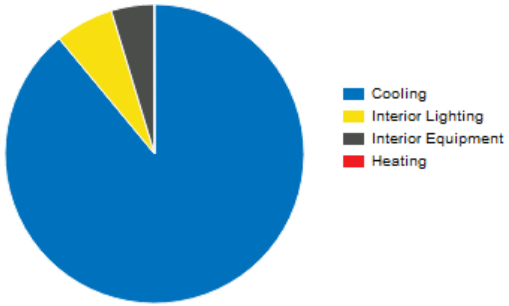


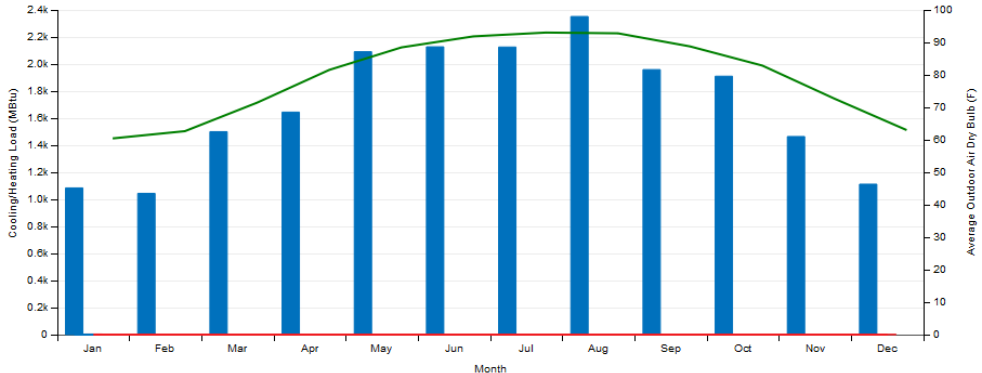
End use in Kuwait and Aswan cities are high compared to Russia and Colombo due to the hot climate there which needs a more effective wall with higher thermal resistance.

Aswan

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	6.07
Space Heating	0.04
Space Cooling	89.48
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	4.40
Miscellaneous	-0.00



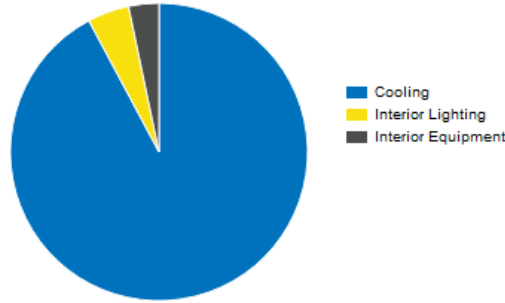


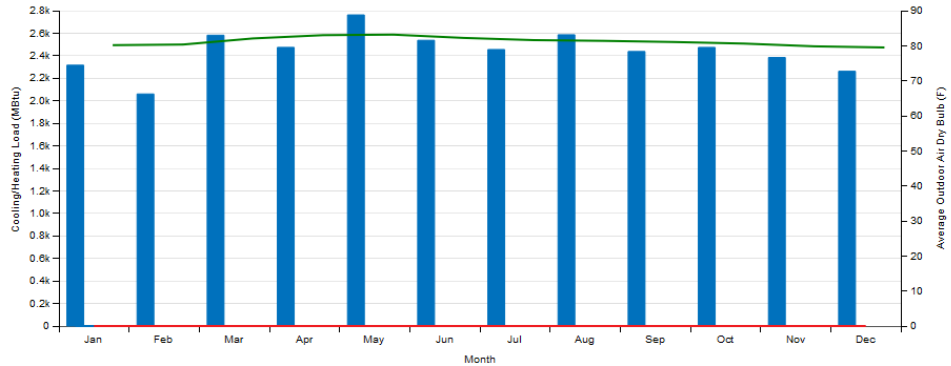
End use in Colombo is high due to the very high humidity there which can't be resisted by the wall material. So the wall is not effective.

Colombo

EAp2-18. End Use Percentage

	Percent [%]
Interior Lighting	4.37
Space Heating	0.00
Space Cooling	92.46
Fans-Interior	0.00
Service Water Heating	0.00
Receptacle Equipment	3.17
Miscellaneous	-0.00





Wall Three – Kuwait

EAp2-6. Energy Use Summary

	Process Subtotal [GJ]	Total Energy Use [GJ]
Electricity	1060.26	2522.39
Natural Gas	0.00	0.00
Additional	0.00	22276.69
Total	1060.26	24799.08

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	24799.08	3936.36	3936.36
Net Site Energy	24799.08	3936.36	3936.36
Total Source Energy	31578.58	5012.47	5012.47
Net Source Energy	31578.58	5012.47	5012.47

Wall Three – Russia

EAp2-6. Energy Use Summary

	Process Subtotal [GJ]	Total Energy Use [GJ]
Electricity	1060.26	2522.39
Natural Gas	0.00	0.00
Additional	0.00	27048.98
Total	1060.26	29571.37

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	29571.37	4693.87	4693.87
Net Site Energy	29571.37	4693.87	4693.87
Total Source Energy	79261.85	12581.25	12581.25
Net Source Energy	79261.85	12581.25	12581.25

Wall Three – Aswan

EAp2-6. Energy Use Summary

	Process Subtotal [GJ]	Total Energy Use [GJ]
Electricity	1060.26	2522.39
Natural Gas	0.00	0.00
Additional	0.00	21548.64
Total	1060.26	24071.03

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	24071.03	3820.80	3820.80
Net Site Energy	24071.03	3820.80	3820.80
Total Source Energy	30758.99	4882.38	4882.38
Net Source Energy	30758.99	4882.38	4882.38

Wall Three – Colombo

EAp2-6. Energy Use Summary

	Process Subtotal [GJ]	Total Energy Use [GJ]
Electricity	1060.26	2522.39
Natural Gas	0.00	0.00
Additional	0.00	30945.88
Total	1060.26	33468.27

Site and Source Energy

	Total Energy [GJ]	Energy Per Total Building Area [MJ/m2]	Energy Per Conditioned Building Area [MJ/m2]
Total Site Energy	33468.27	5312.42	5312.42
Net Site Energy	33468.27	5312.42	5312.42
Total Source Energy	40656.94	6453.48	6453.48
Net Source Energy	40656.94	6453.48	6453.48

Utility Use & Loads - Wall Three

Kuwait

Utility Use Per Conditioned Floor Area

	Electricity Intensity [MJ/m2]	Natural Gas Intensity [MJ/m2]	Additional Fuel Intensity [MJ/m2]	District Cooling Intensity [MJ/m2]	District Heating Intensity [MJ/m2]	Water Intensity [m3/m2]
Lighting	232.08	0.00	0.00	0.00	0.00	0.00
HVAC	0.00	0.00	0.00	3531.43	4.56	0.00
Other	168.29	0.00	0.00	0.00	0.00	0.00
Total	400.38	0.00	0.00	3531.43	4.56	0.00

Aswan

	Electricity Intensity [MJ/m2]	Natural Gas Intensity [MJ/m2]	Additional Fuel Intensity [MJ/m2]	District Cooling Intensity [MJ/m2]	District Heating Intensity [MJ/m2]	Water Intensity [m3/m2]
Lighting	232.08	0.00	0.00	0.00	0.00	0.00
HVAC	0.00	0.00	0.00	3419.03	1.39	0.00
Other	168.29	0.00	0.00	0.00	0.00	0.00
Total	400.38	0.00	0.00	3419.03	1.39	0.00

Colombo

Utility Use Per Conditioned Floor Area

	Electricity Intensity [MJ/m2]	Natural Gas Intensity [MJ/m2]	Additional Fuel Intensity [MJ/m2]	District Cooling Intensity [MJ/m2]	District Heating Intensity [MJ/m2]	Water Intensity [m3/m2]
Lighting	232.08	0.00	0.00	0.00	0.00	0.00
HVAC	0.00	0.00	0.00	4912.04	0.00	0.00
Other	168.29	0.00	0.00	0.00	0.00	0.00
Total	400.38	0.00	0.00	4912.04	0.00	0.00

Russia

Utility Use Per Conditioned Floor Area

	Electricity Intensity [MJ/m2]	Natural Gas Intensity [MJ/m2]	Additional Fuel Intensity [MJ/m2]	District Cooling Intensity [MJ/m2]	District Heating Intensity [MJ/m2]	Water Intensity [m3/m2]
Lighting	232.08	0.00	0.00	0.00	0.00	0.00
HVAC	0.00	0.00	0.00	1642.34	2651.15	0.00
Other	168.29	0.00	0.00	0.00	0.00	0.00
Total	400.38	0.00	0.00	1642.34	2651.15	0.00

Thank You.

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