< technical
environmental
systems >

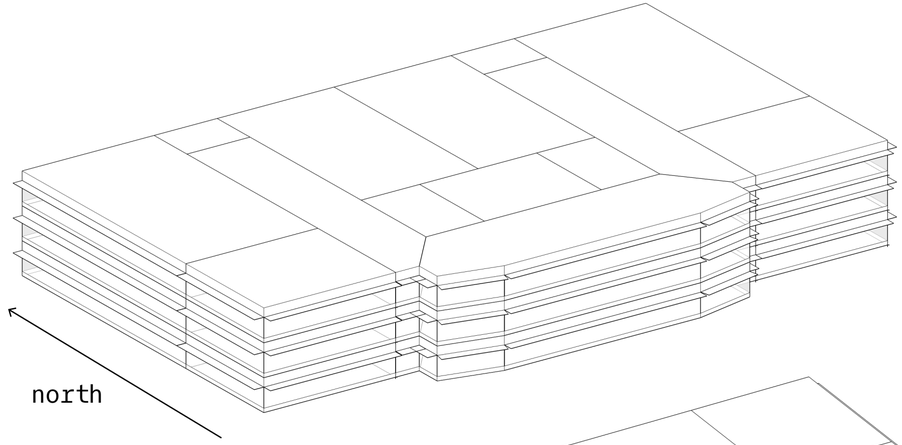
project/ Building_Simulation

professor/ najafi behzad

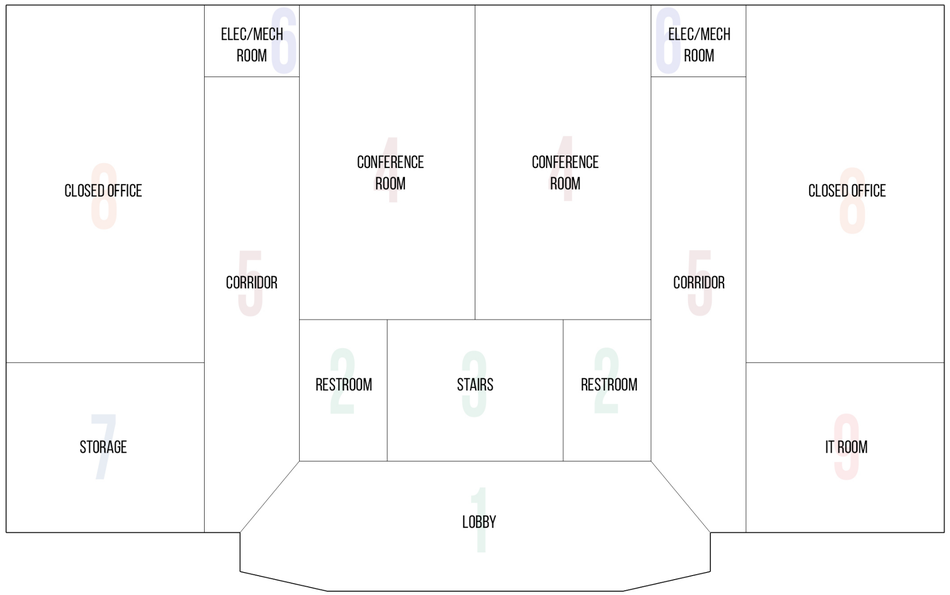
members/ pletneva tatiana [10687319]
ahmadi ali [10703882]
gaini angela [10488321]
vij jagrit [10654065]

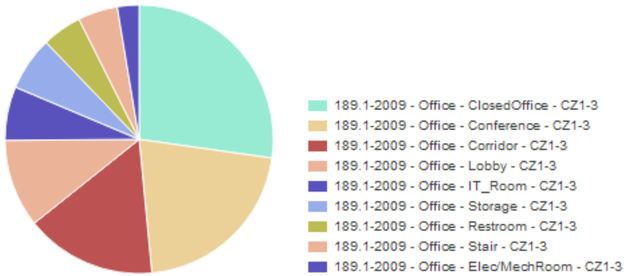
building_information/

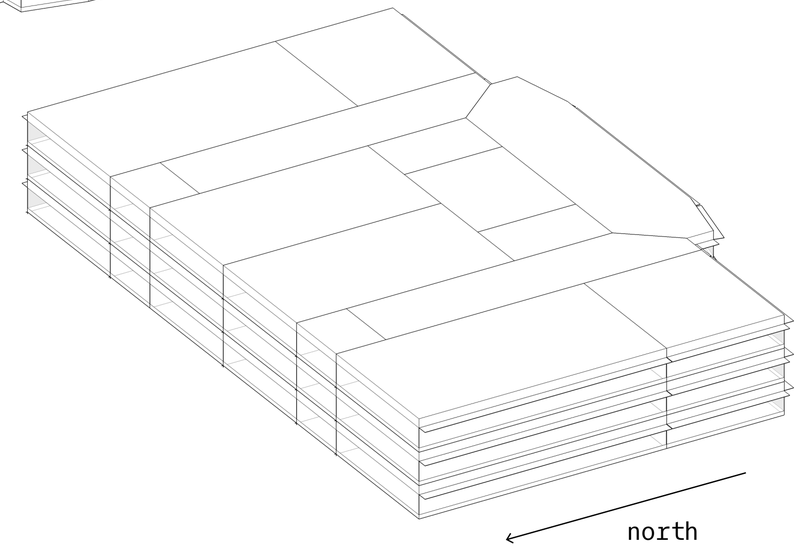
Building type: commercial/office
Total Building Area: 3787.96 m2



zones;thermal_zones/







basic_wall/

	[m] thickness	[W/m*K] conductivity	[kg/m3] density	[J/kg*K] specific heat	thermal absorptance	solar absorptance	visible absorptance	[m2*C/W] R-value
1IN Stucco	0.025300	0.691800	1858.0	837	0.900000	0.920000	0.920000	0.036
8IN Concrete HW	0.203300	1.729600	2243.0	837	0.900000	0.650000	0.650000	0.12
Wall insulation [44]	0.110400	0.043200	91.0	837	0.900000	0.500000	0.500000	2.56
1/2IN Gypsum	0.012700	0.160000	784.9	830	0.900000	0.400000	0.400000	0.079

* R_value = thickness/conductivity
* U_value = 1/R_total

R_total: 2.795 [m2*C/W]
U_value: 0.357 [W/m2*C]

consumption_comparison/

3_different_cities

		24.43°N,54.65°E Abu_Dhabi, UAE/		28.58°N,77.20°E New_Delhi, India/		24.43°N,54.65°E Oslo, Norway/	
average outdoor temperature	[annual]	26.8	[°C]	24.6	[°C]	6.6	[°C]
heating consumption [end use]		87597 25.6	[kBtu] [MWh]	238319 69.8	[kBtu] [MWh]	3424084 1003.4	[kBtu] [MWh]
cooling consumption [end use]		1943044 569.4	[kBtu] [MWh]	1556335 456.1	[kBtu] [MWh]	11175 3.2	[kBtu] [MWh]
electricity:	[end use]						
/interior lighting		414537 121.4	[kBtu] [MWh]	414537 121.4	[kBtu] [MWh]	414537 121.4	[kBtu] [MWh]
/interior equipment		261598 76.6	[kBtu] [MWh]	261598 76.6	[kBtu] [MWh]	261598 76.6	[kBtu] [MWh]

Heating consumption is 92.7 % HIGHER
Cooling consumption is 22.1 % LOWER
with respect to the Abu Dhabi case

Heating consumption is 190 % HIGHER
Cooling consumption is 198 % LOWER
with respect to the Abu Dhabi case

building_information/

3_different_walls

basic_wall [type_1]/

	[m] thickness	[W/m*K] conductivity	[kg/m3] density	[J/kg*K] specific heat	thermal absorptance	solar absorptance	visible absorptance	[m2*C/W] R-value
1IN Stucco	0.025300	0.691800	1858.0	837	0.900000	0.920000	0.920000	0.036
8IN Concrete HW	0.203300	1.729600	2243.0	837	0.900000	0.650000	0.650000	0.12
Wall insulation [44]	0.110400	0.043200	91.0	837	0.900000	0.500000	0.500000	2.56
1/2IN Gypsum	0.012700	0.160000	784.9	830	0.900000	0.400000	0.400000	0.079

R_total: 2.795 [m2*C/W]
U_value: 0.357 [W/m2*C]

type_2/

1IN Stucco	0.025300	0.691800	1858.0	837	0.900000	0.920000	0.920000	0.036
5IN Concrete HW	0.127000	1.729600	2243.0	837	0.900000	0.650000	0.650000	0.074
Wall insulation [44]	0.110400	0.043200	91.0	837	0.900000	0.500000	0.500000	2.56
F16 Acoustic tile	0.019100	0.060000	368.0	590	0.900000	0.300000	0.300000	0.32
1/2IN Gypsum	0.012700	0.160000	784.9	830	0.900000	0.400000	0.400000	0.079

R_total: 3.069 [m2*C/W]
U_value: 0.325 [W/m2*C]

>> Total resistance is 9.3 % HIGHER
U_value is 9.3 % LOWER, with respect to the basic wall [type_1]

type_3/

G05 25mm wood	0.025400	0.150000	608.0	1630	0.900000	0.500000	0.500000	0.17
12IN Concrete HW	0.203300	1.729600	2243.0	837	0.900000	0.650000	0.650000	0.118
Wall insulation [44]	0.110400	0.043200	91.0	837	0.900000	0.500000	0.500000	2.56
Wall insulation [44]	0.110400	0.043200	91.0	837	0.900000	0.500000	0.500000	2.56
1/2IN Gypsum	0.012700	0.160000	784.9	830	0.900000	0.400000	0.400000	0.079

R_total: 5.487 [m2*C/W]v
U_value: 0.182 [W/m2*C]

>> Total resistance is 65.0 % HIGHER
U_value is 65.0 % LOWER, with respect to the basic wall [type_1]

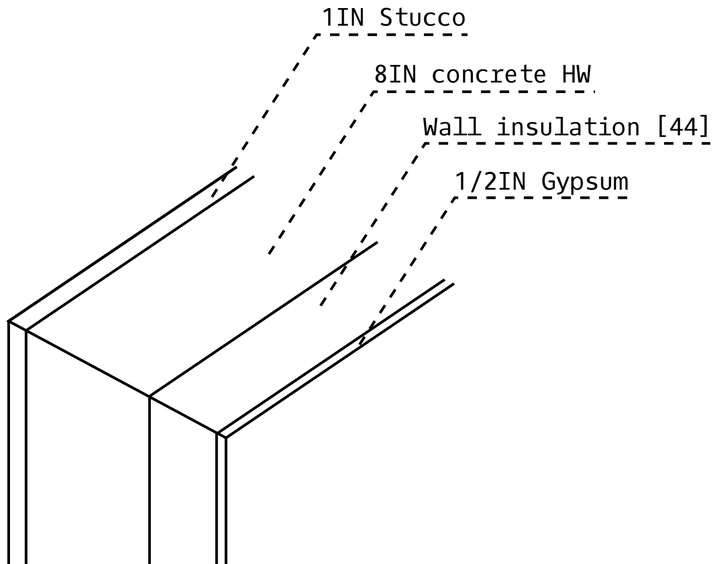
consumption_comparison/

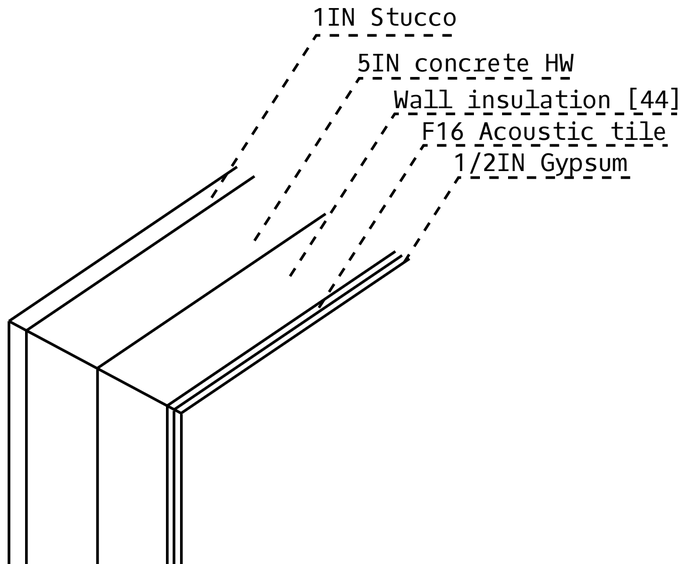
3_different_walls

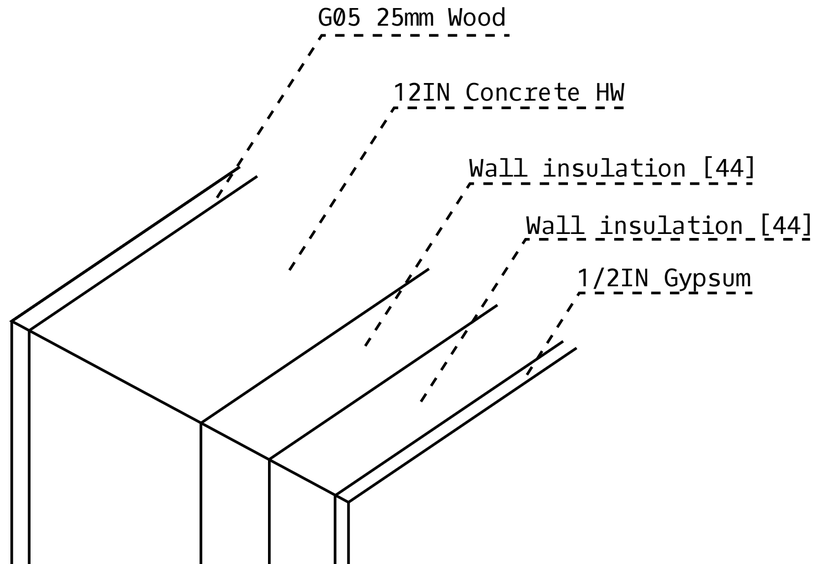
	basic_wall [type_1]/	type_2/	type_3/
heating consumption [end use]	87597 [kBtu]	88261 [kBtu]	90365 [kBtu]
	25.6 [MWh]	25.8 [MWh]	26.4 [MWh]
cooling consumption [end use]	1943044 [kBtu]	1973452 [kBtu]	1907349 [kBtu]
	569.4 [MWh]	578.3 [MWh]	558.9 [MWh]

Heating consumption is 0.7 % HIGHER
Cooling consumption is 0.19 % LOWER
with respect to the basic wall [type_1]

Heating consumption is 3.0 % HIGHER
Cooling consumption is 1.8 % LOWER
with respect to the basic wall [type_1]







monthly_review/

3_different_walls

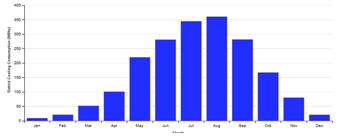
basic_wall [type_1]/

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
cooling [Mbtu]	9.08	21.09	52.0	100.76	220.42	281.73	345.75	361.49	282.15	167.45	80.4	20.74	1943.04

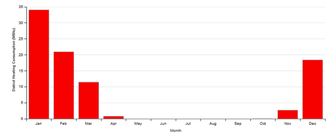
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
heating [Mbtu]	33.87	20.75	11.34	.77	0	0	0	0	0	0	2.63	18.24	87.6

type_2/

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
cooling [Mbtu]	9.0	20.94	51.78	100.45	219.91	281.03	344.89	360.58	281.35	166.91	79.99	20.59	1937.45



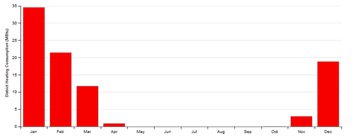
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
heating [Mbtu]	34.05	20.91	11.44	0.79	0	0	0	0	0	0	2.68	18.39	88.26



type_3/

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
cooling [Mbtu]	9.08	21.09	52.0	100.76	220.42	281.73	345.75	361.49	282.15	167.45	80.4	20.74	1943.04

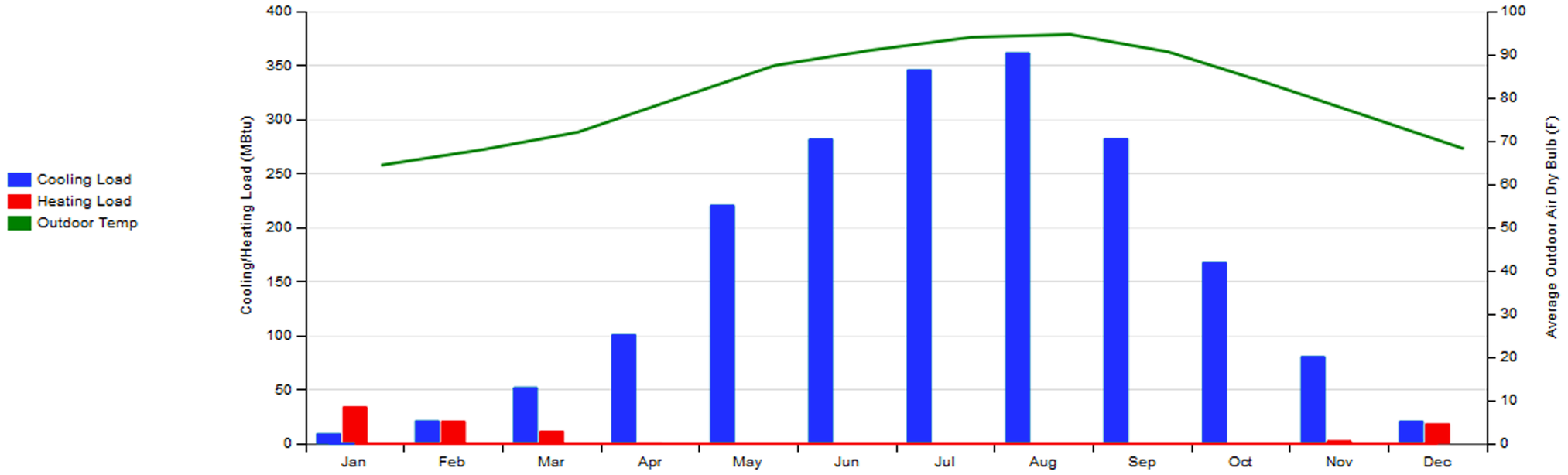
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
heating [Mbtu]	34.56	21.45	11.73	0.86	0	0	0	0	0	0	2.93	18.83	90.16



hvac_systems_load/

3_different_walls

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
average outdoor air dry bulb [F]	64.4	67.9	72.0	79.8	87.5	91.1	94.0	94.6	90.6	83.4	75.8	68.2
basic_wall [type_1]/												
cooling Load [MBtu]	9.08	21.09	52.0	100.76	220.42	281.73	345.75	361.49	282.15	167.45	80.4	20.74
heating Load [MBtu]	33.87	20.75	11.34	0.77	0.0	0.0	0.0	0.0	0.0	0.0	2.63	18.24
type_2/												
cooling Load [MBtu]	9.0	20.94	51.78	100.45	219.91	281.03	344.89	360.58	281.35	166.91	79.9	20.59
heating Load [MBtu]	34.05	20.91	11.44	0.79	0.0	0.0	0.0	0.0	0.0	0.0	2.68	18.39
type_3/												
cooling Load [MBtu]	8.66	20.28	50.87	98.86	216.7	277.18	339.93	355.63	277.1	163.87	78.25	20.03
heating Load [MBtu]	34.56	21.45	11.73	0.86	0.0	0.0	0.0	0.0	0.0	0.0	2.93	18.83



conclusions/ Building_Simulation

This simulation project shows, that differences in enegry consumption of the building depend on the cilmate zone, as well as on the construction materials used.

Concerning the software, OpenStudio allows us to easily calculate various cosumptions & loads of the building at the early design stage. This provides an opportunity to prevent extra costs.