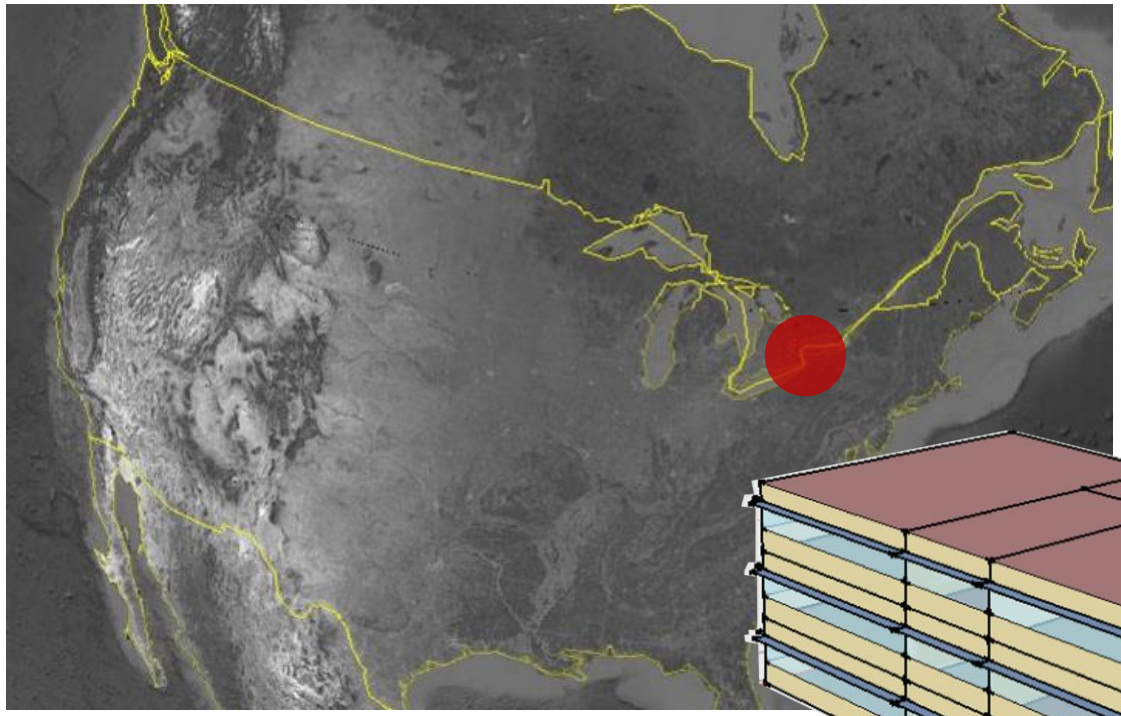
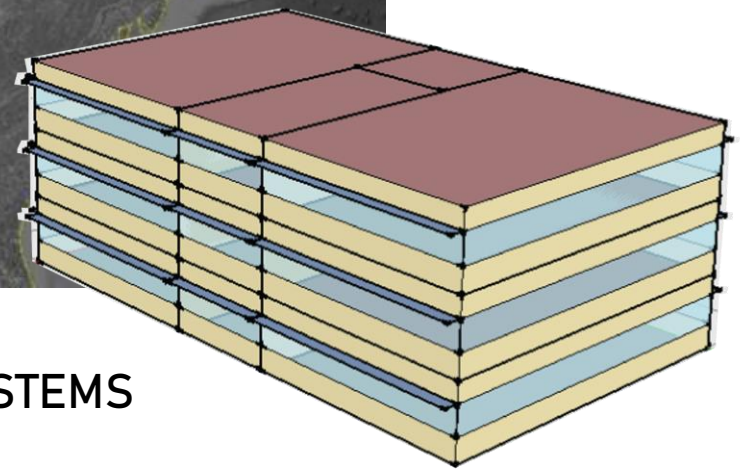


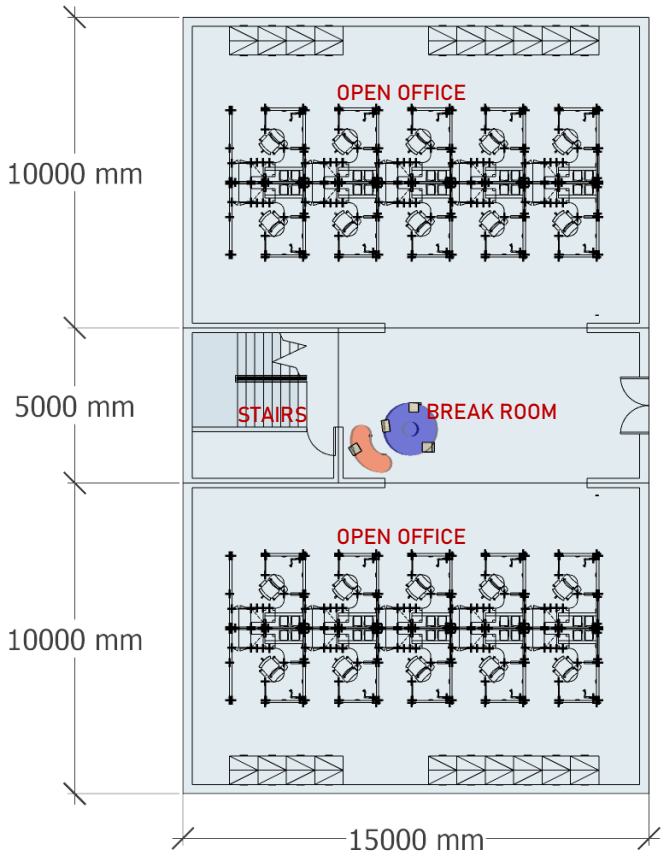


OPEN STUDIO Building Simulation
TECHNICAL ENVIRONMENTAL SYSTEMS

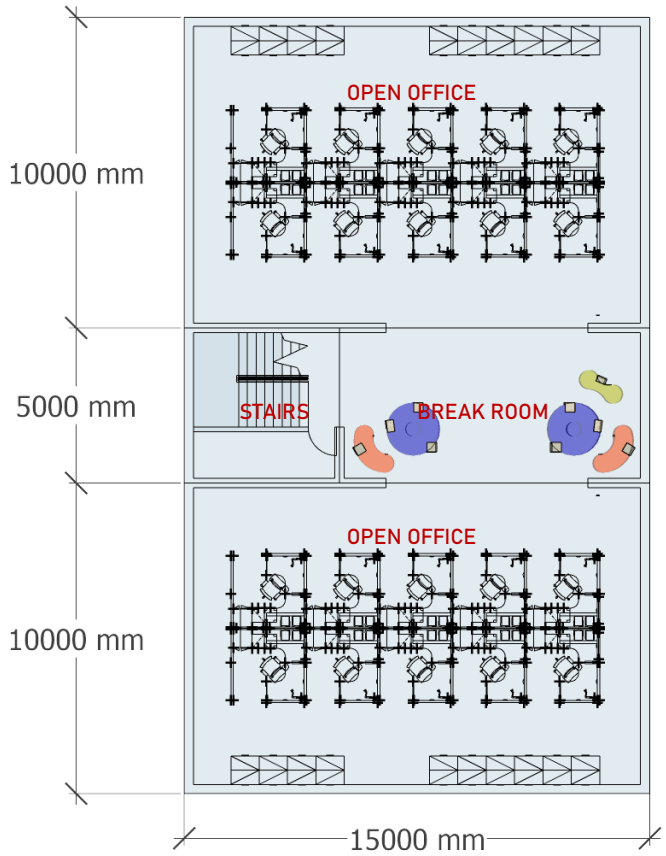
W18

ANDREA FOPPIANI
MELISSA MARTINOLI
DAVIDE MONTANARI
LISANA SHIDQINA

FLOOR PLAN & BUILDING DETAILS

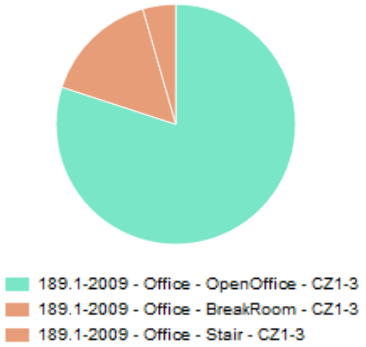


GROUND FLOOR PLAN

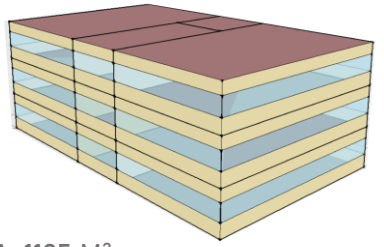


TYPICAL 1ST & 2ND FLOOR PLAN

SPACE TYPE BREAKDOWN

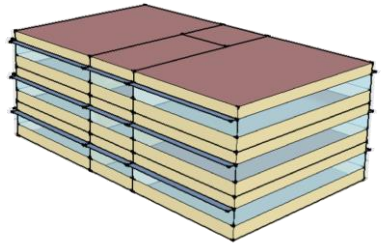


BUILDING WITH 40% WINDOW/WALL RATIO



TOTAL BUILDING AREA: 1125 M^2

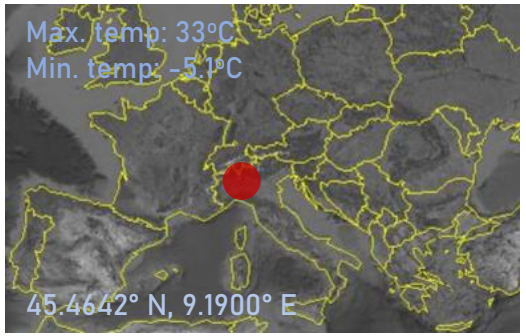
BUILDING WITH OVERHANGS (EXCLUDING NORTH SIDE)



OVERVIEW

Location, climate conditions, and energy consumption per location

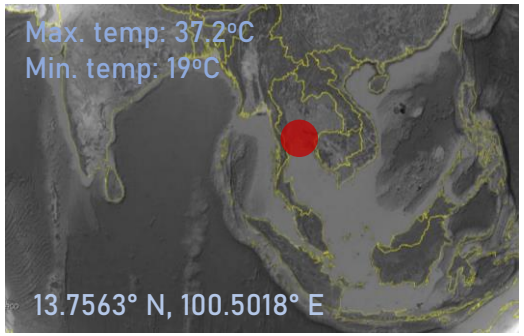
MILAN



Site and Source Energy

	Total Energy [GJ]
Total Site Energy	801.15
Net Site Energy	801.15
Total Source Energy	2205.14
Net Source Energy	2205.14

BANGKOK

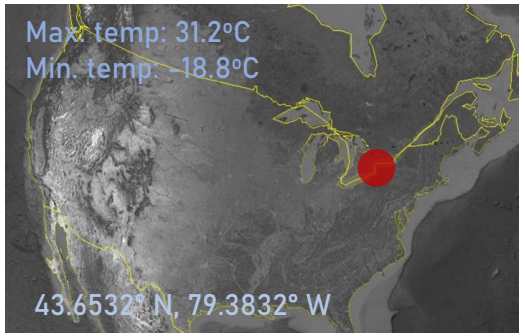


Site and Source Energy

	Total Energy [GJ]
Total Site Energy	1347.46
Net Site Energy	1347.46
Total Source Energy	2264.70
Net Source Energy	2264.70

HIGHEST ENERGY CONSUMED

TORONTO



Site and Source Energy

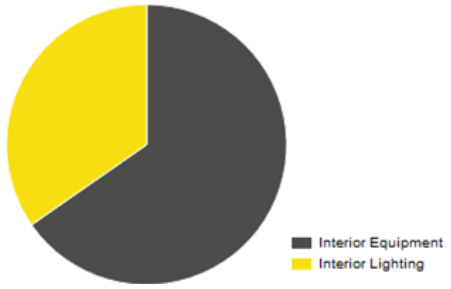
	Total Energy [GJ]
Total Site Energy	967.33
Net Site Energy	967.33
Total Source Energy	2976.41
Net Source Energy	2976.41

OPEN STUDIO RESULTS

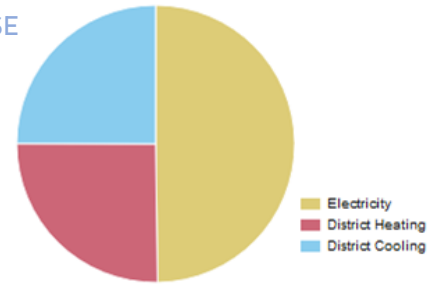
Different climates influence different aspects of the end use

MILAN

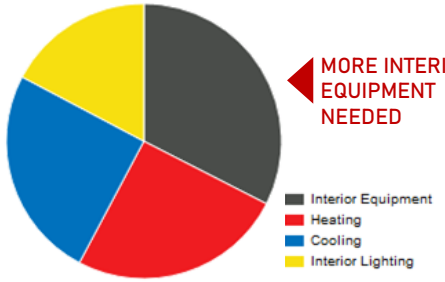
ELECTRICITY



ENERGY USE

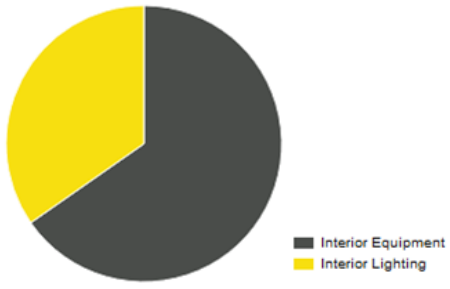


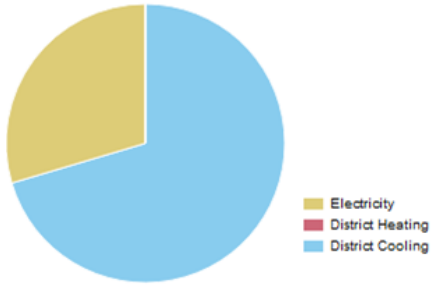
END USE

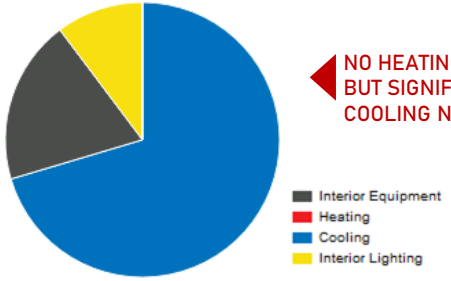


MORE INTERIOR EQUIPMENT NEEDED

BANGKOK

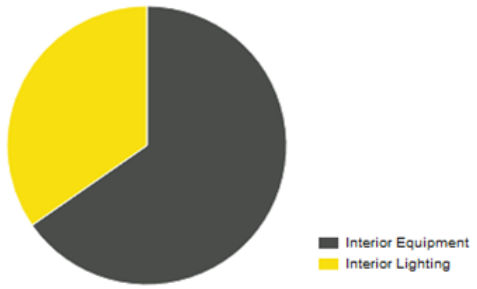


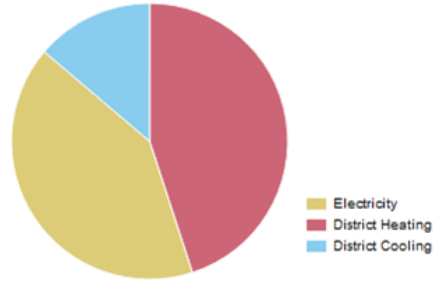


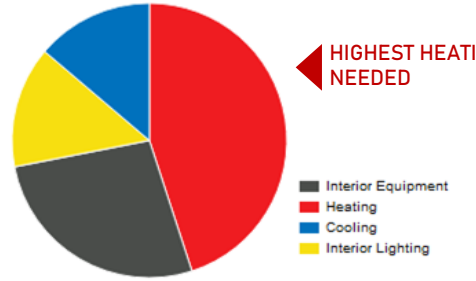


NO HEATING, BUT SIGNIFICANT COOLING NEEDED

TORONTO





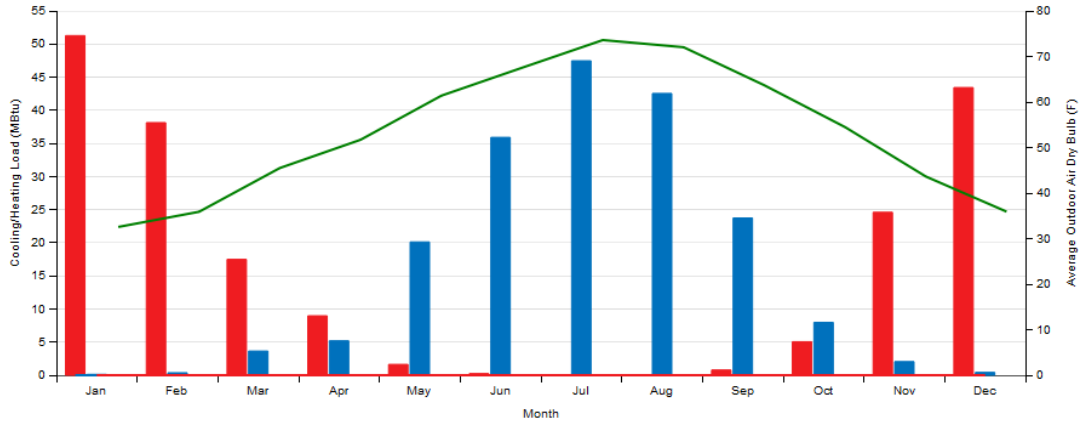


HIGHEST HEATING NEEDED

OPEN STUDIO RESULTS

Overall heating & cooling loads relating to the outdoor temperature in each location

MILAN – HVAC LOAD PROFILES

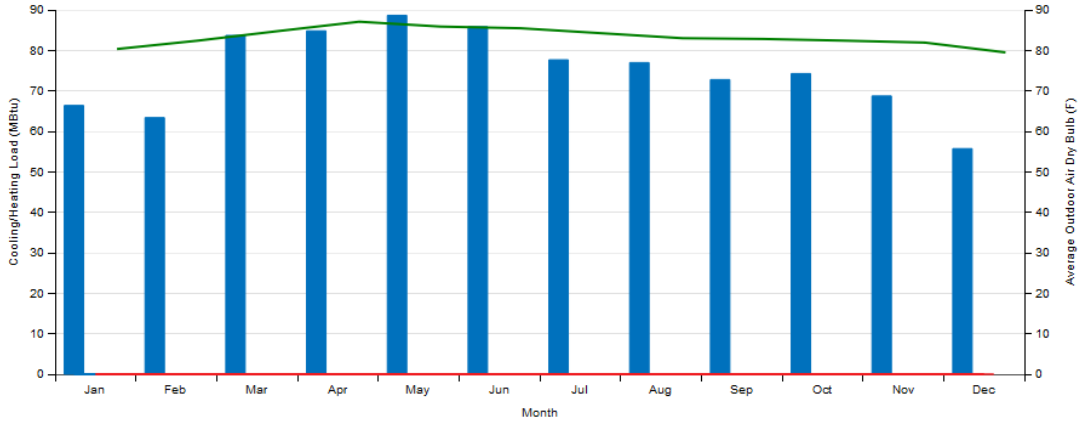


ALTERNATING TEMPERATURE,
ALTERNATING ENERGY NEEDS

Heating Load
Cooling Load
Outdoor Temp

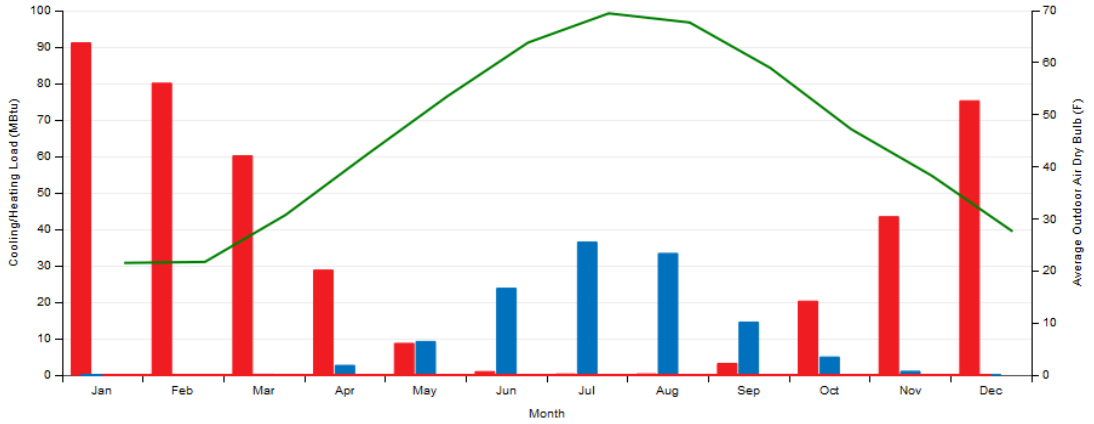
BANGKOK – HVAC LOAD PROFILES

CONSTANT HIGH TEMPERATURE
& COOLING NEED



TORONTO – HVAC LOAD PROFILES

HIGHER TEMPERATURE DIFFERENCES,
MOST HEATING NEEDED

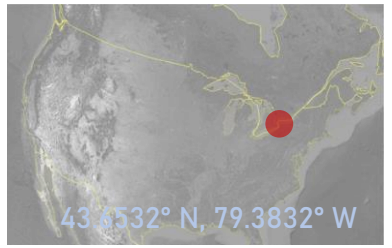


WALL SIMULATION PROFILES

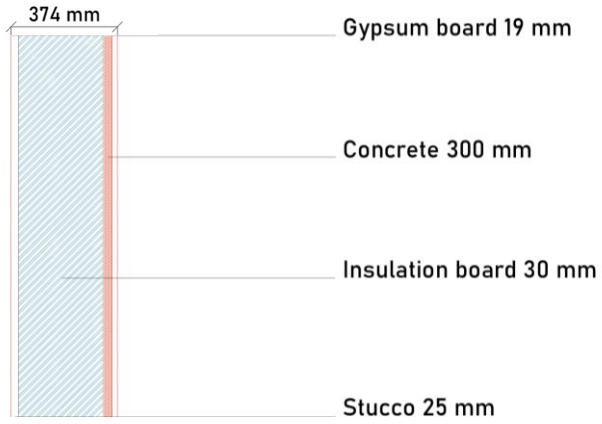
Simulation on different wall types to overcome climatic problems.

TORONTO

Max. temp: 31.2°C
Min. temp: -18.8°C



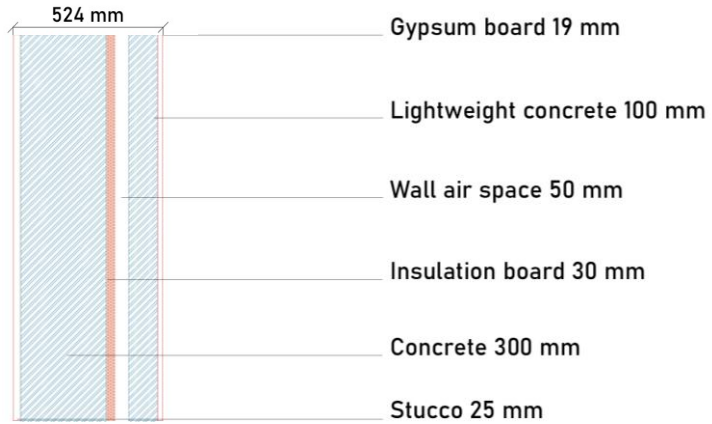
WALL 1 : BASE CASE



TOTAL SITE ENERGY: 953.90 GJ
R-VALUE: 7.55 FT^2 * h * R / Btu
U-VALUE: 0.749 W / m^2 * K

WINDOW U-FACTOR: 1.13 Btu / FT^2 * h * R

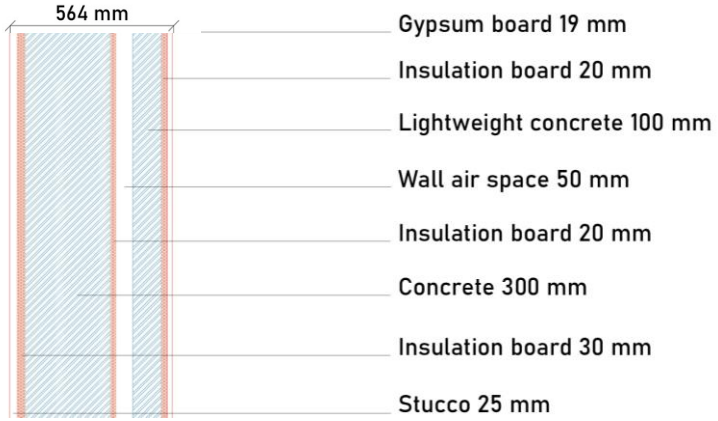
WALL 2 : Base case + air layer and light concrete



TOTAL SITE ENERGY: 938.61 GJ
R-VALUE: 10.05 FT^2 * h * R / Btu
U-VALUE: 0.562 W / m^2 * K

WINDOW U-FACTOR: 1.13 Btu / FT^2 * h * R

WALL 3 : Base case + air layer and light concrete + second and third insulation layer



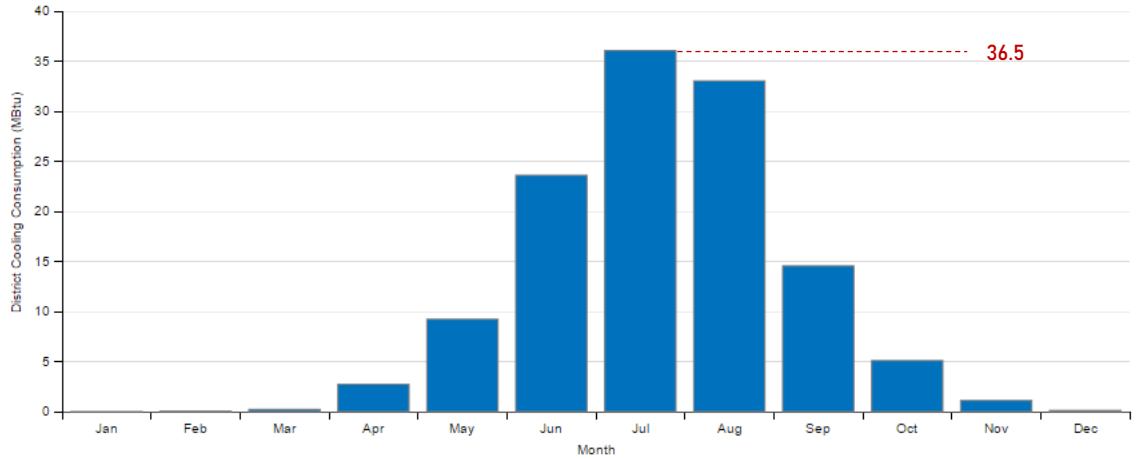
TOTAL SITE ENERGY: 923.05 GJ
R-VALUE: 17.62 FT^2 * h * R / Btu
U-VALUE: 0.317 W / m^2 * K

WINDOW U-FACTOR: 1.13 Btu / FT^2 * h * R

WALL SIMULATION RESULTS - COOLING

WALL 1

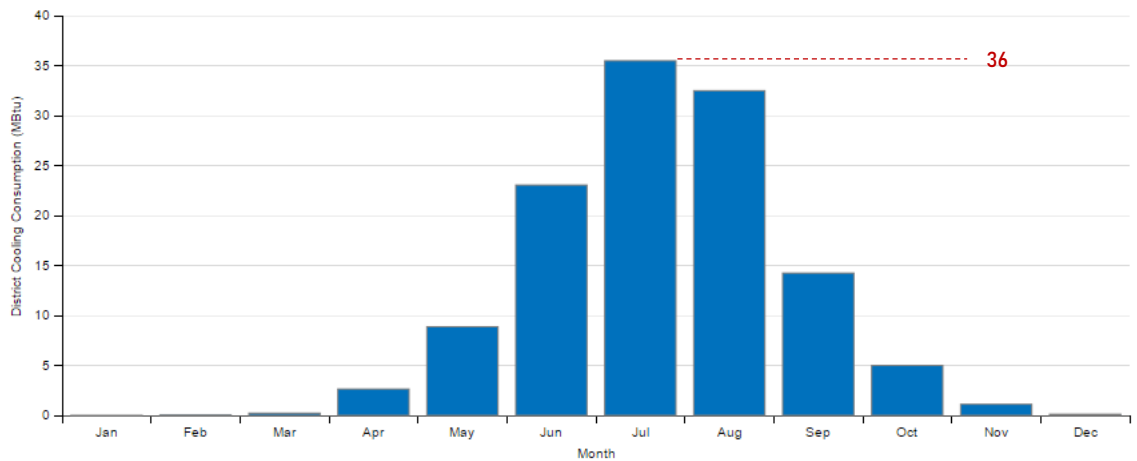
District Cooling Consumption (MBtu) - view table



COOLING CONSUMPTION DECREASES SLIGHTLY BETWEEN THE THREE WALLS.

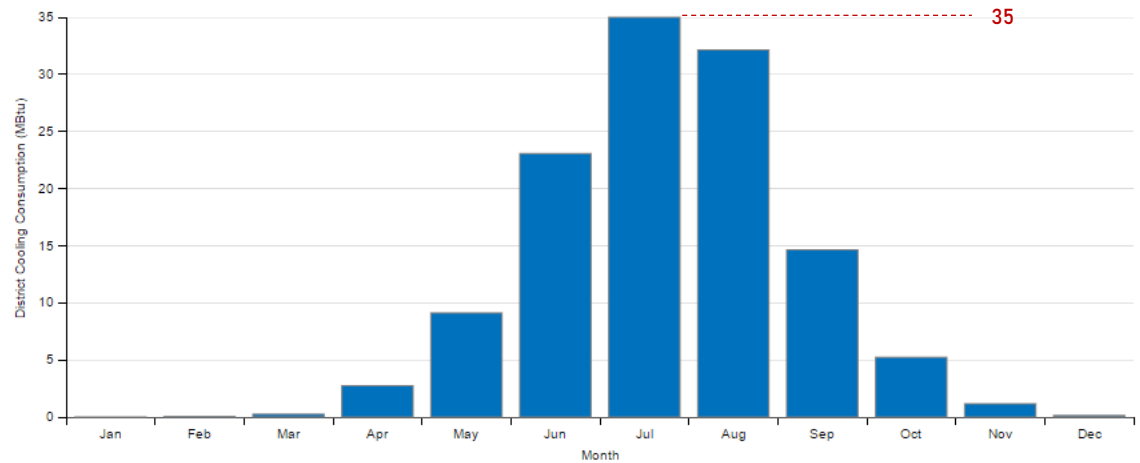
WALL 2

District Cooling Consumption (MBtu) - view table



WALL 3

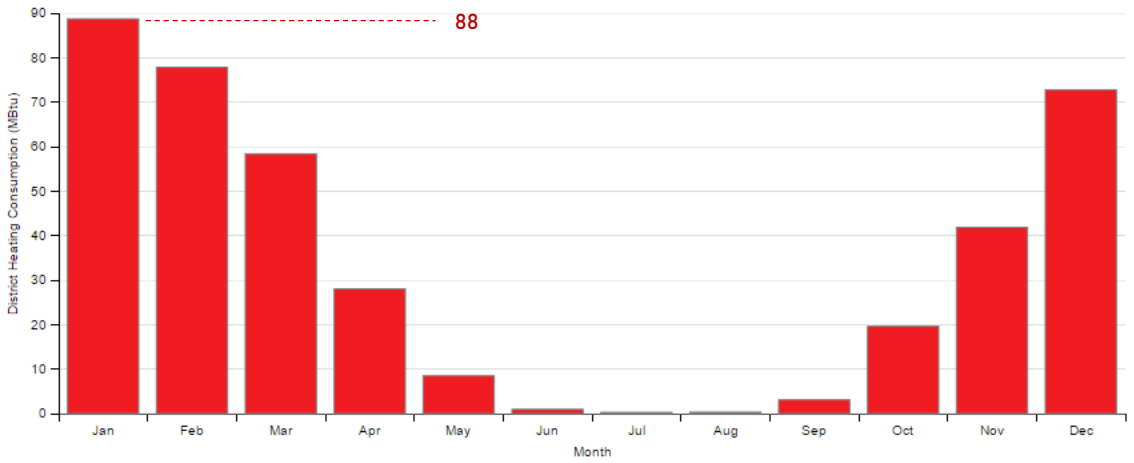
District Cooling Consumption (MBtu) - view table



WALL SIMULATION RESULTS - HEATING

WALL 1

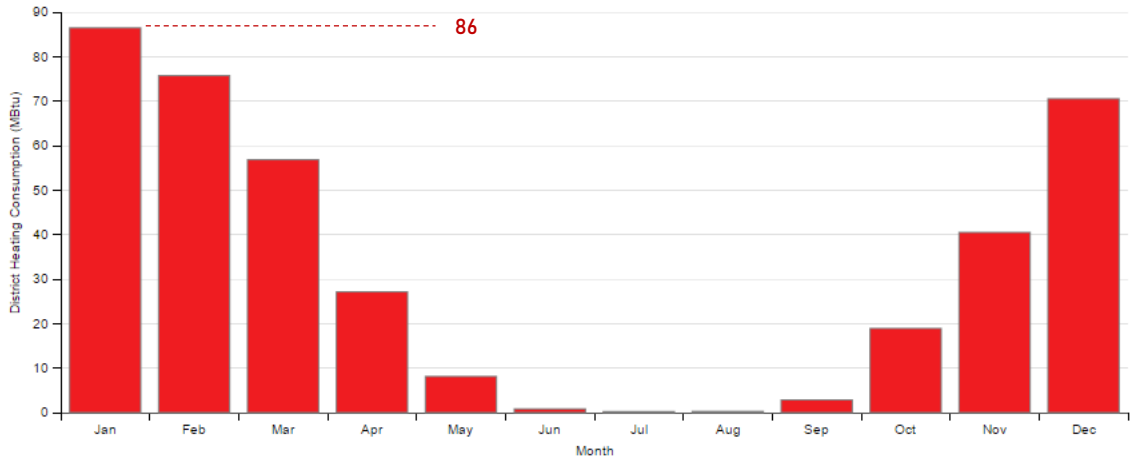
District Heating Consumption (MBtu) - view table



HEATING CONSUMPTION DECREASES NOTICEABLY BETWEEN THE THREE WALLS.

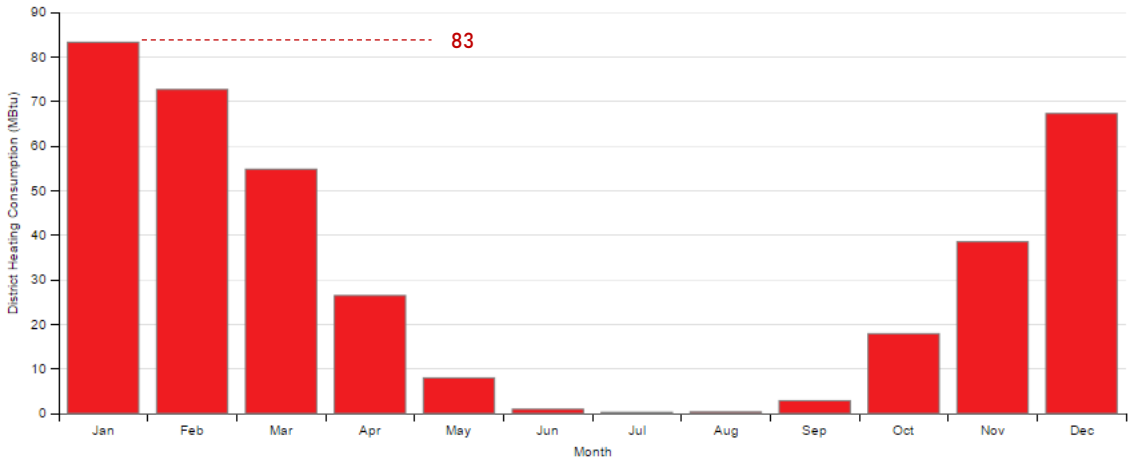
WALL 2

District Heating Consumption (MBtu) - view table



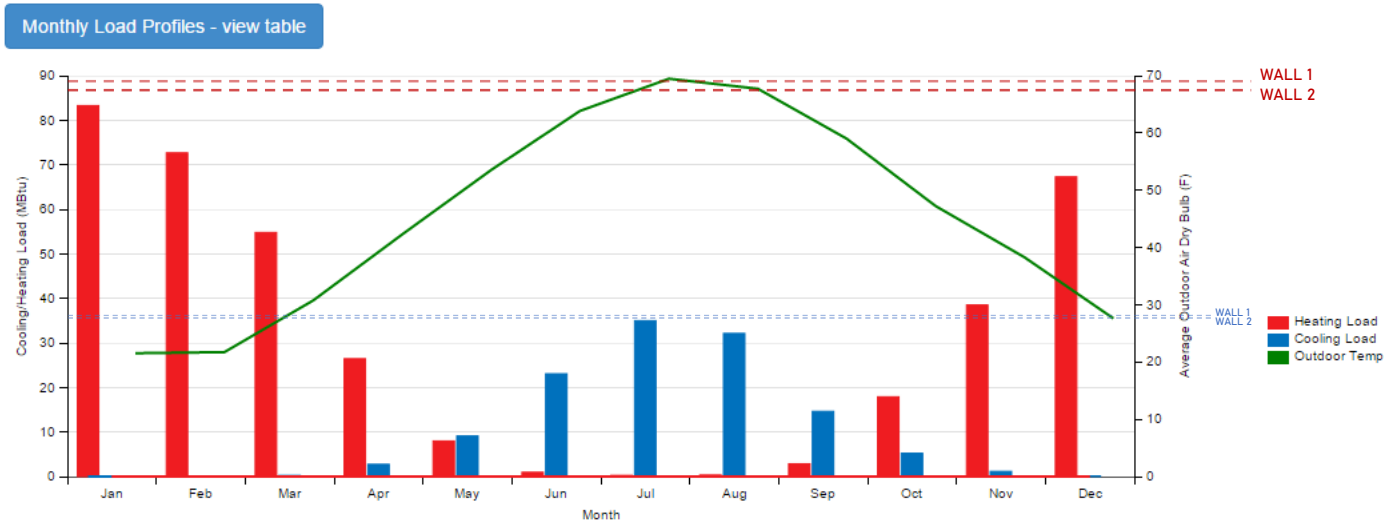
WALL 3

District Heating Consumption (MBtu) - view table



CONCLUSION

HVAC Load Profiles



Adding air gap and extra insulation contributes to the resistance of the wall. The wall is able to retain more energy, and therefore lessen energy loss.

WALL 3 is an ideal solution for the specific location, however, WALL 2 may be a good economical compromise between the three types of walls.

WALL 3 : Base case + air layer and light concrete + second and third insulation layer

TOTAL SITE ENERGY: 923.05 GJ
R-VALUE: 17.62 FT^2 * h * R / Btu
U-VALUE: 0.317 W / m^2 * K