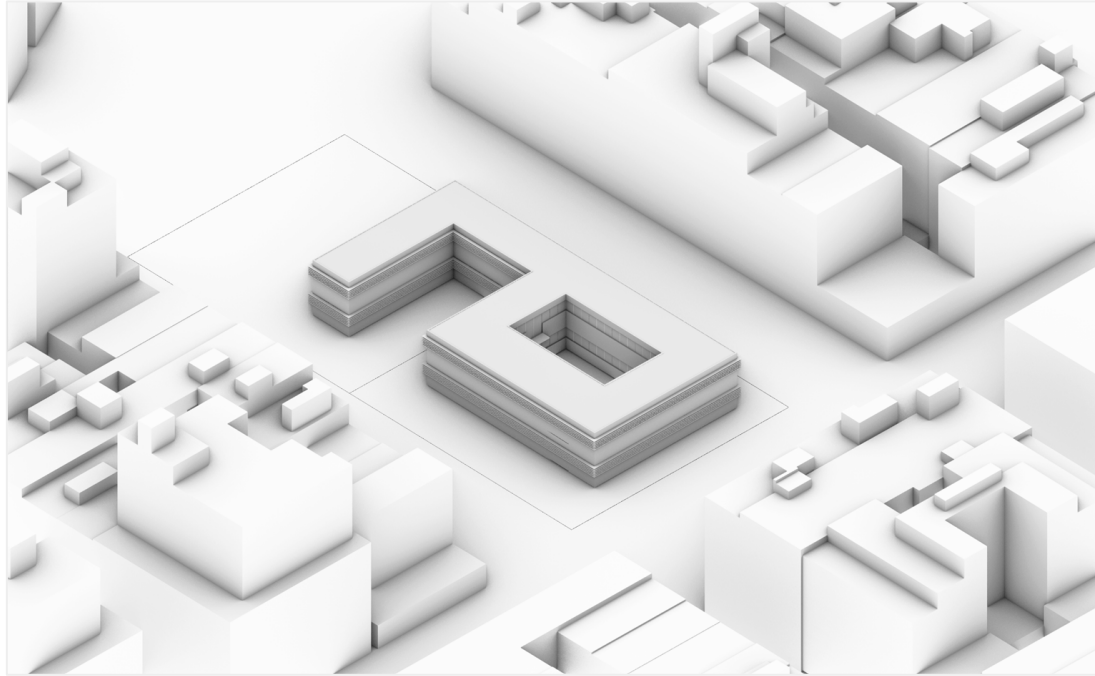


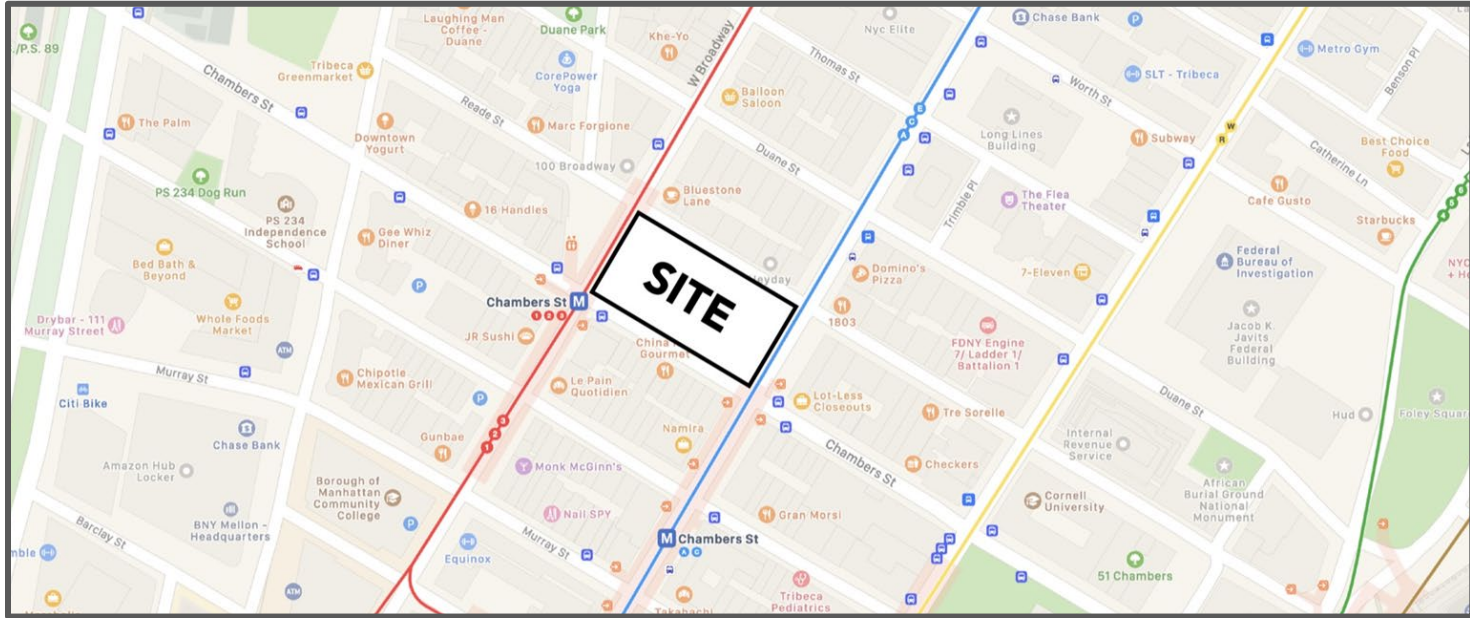
4.401/4.464 Environmental Technologies in Buildings

Final Course Project



Luke Bastian / Alex Steelman / Kuang Chun Lo

PROJECT SITE (L)



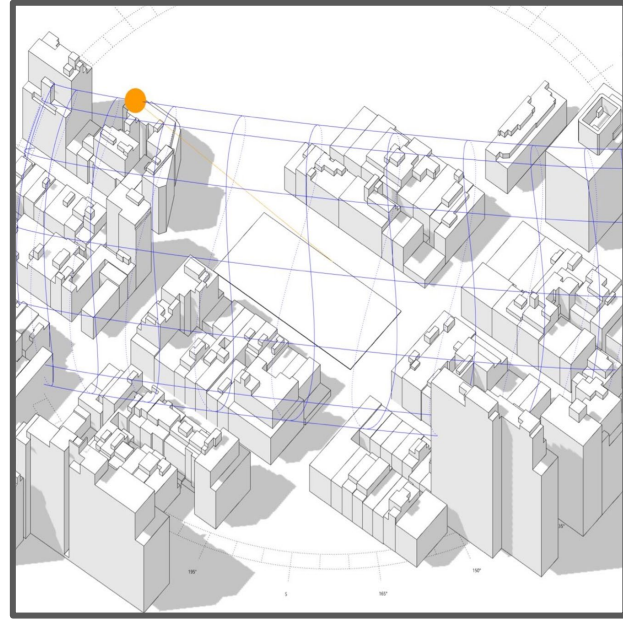
Location: 126 Chambers St, New York

Growing business district / lack green spaces

PROJECT SITE (M)

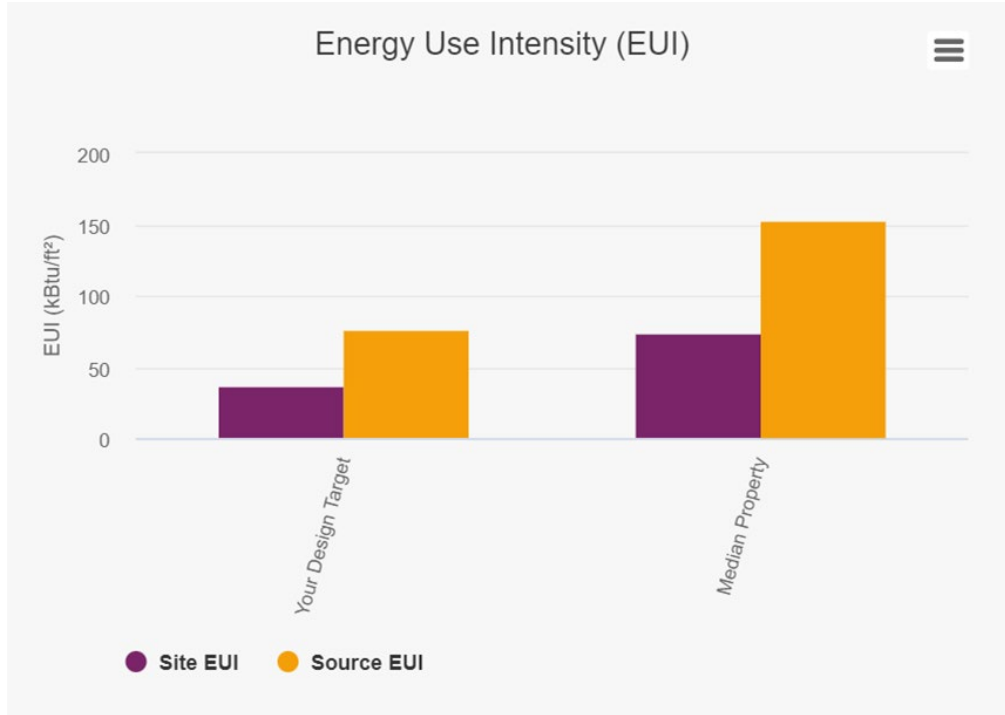


Existing Condition:
old office buildings



Shadow Condition:
Summer solstice shadow

EUI TARGET



Our goal:

50% better than median property EUI

Target Site EUI: 36.6 (kBtu/ft²)
= 115 kWh/m²

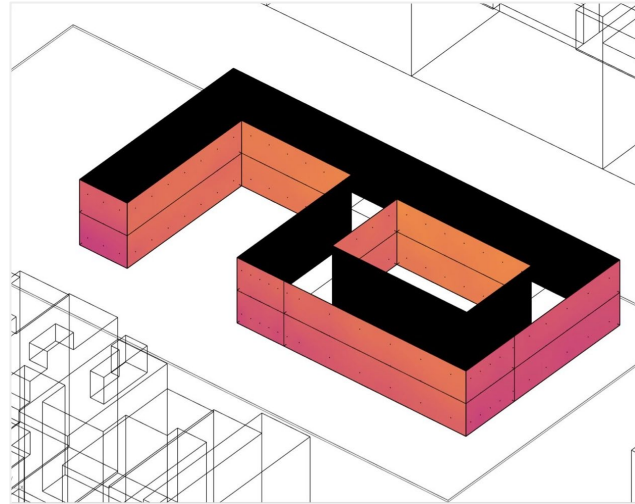
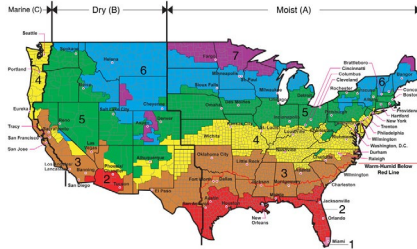
Target Site Energy Use:
= 115

kWh/m² x 2500 m²
= 287,500 kWh

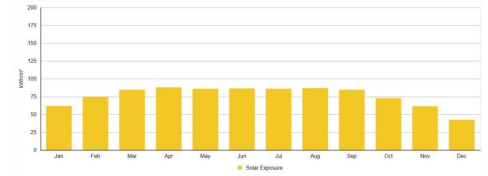
CLIMATE ANALYSIS

Facade Radiation

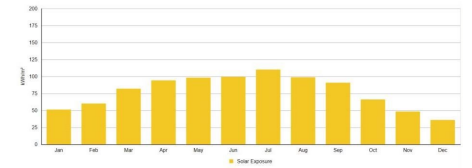
ASHRAE Zone 4A



East Facade

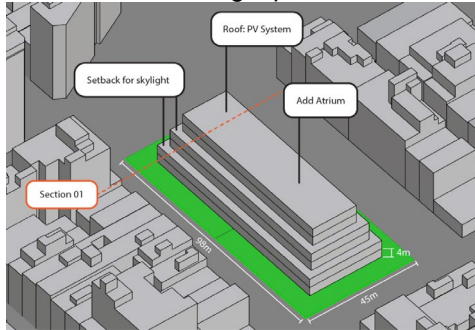


South Facade

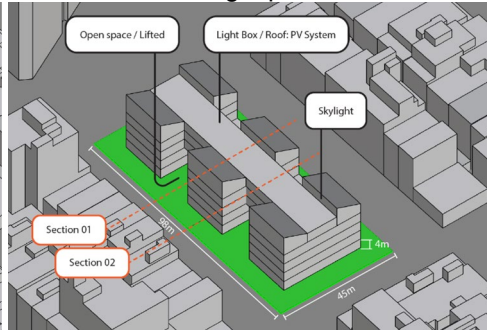


DAYLIGHTING: MASSING MODELS

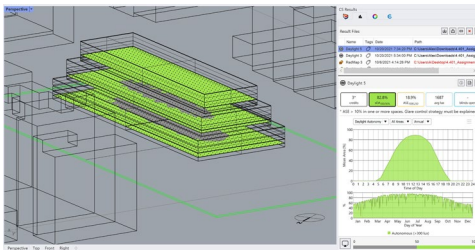
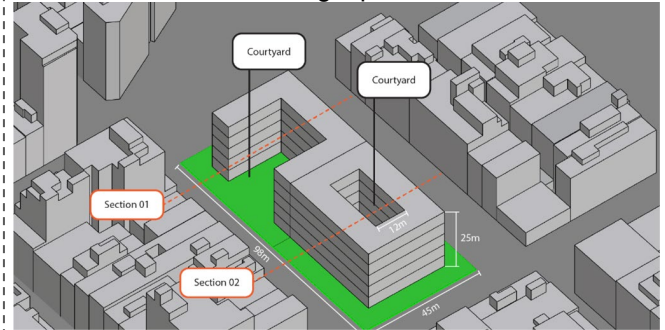
Massing Option 1



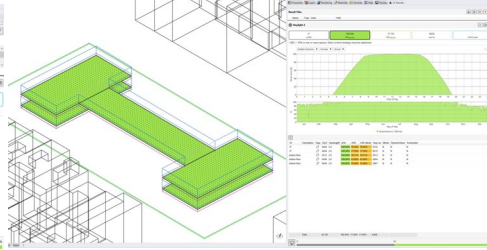
Massing Option 2



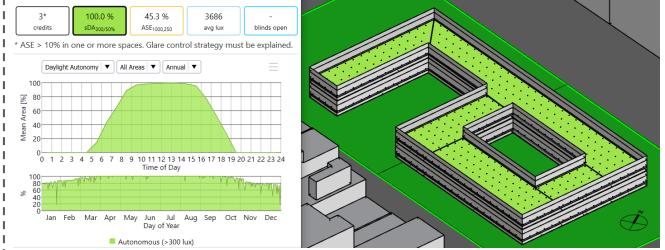
Massing Option 3



sDA_{300lux/50%}: 82.8%
Average Lux: 1687 lux

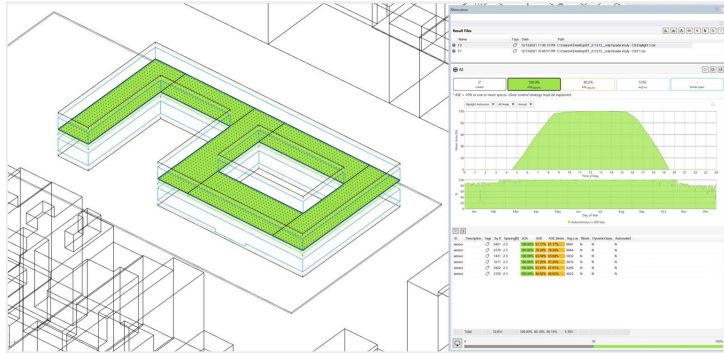
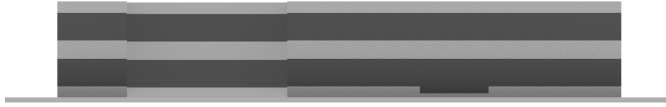


sDA_{300lux/50%}: 100%
Average Lux: 4656 lux

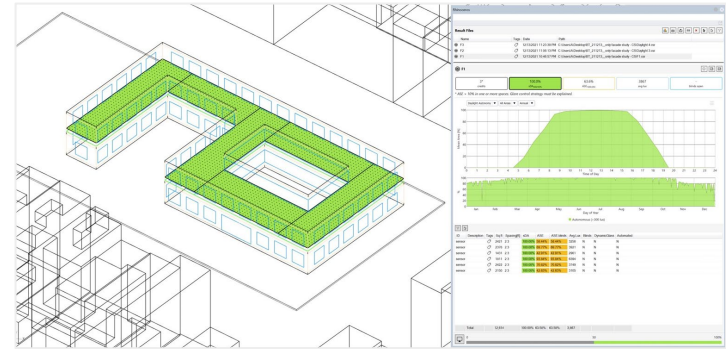
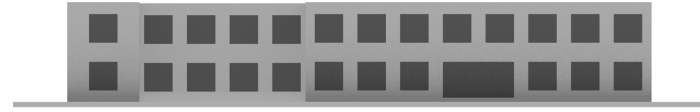


sDA_{300lux/50%}: 100%
Average Lux: 3600 lux

FACADE STUDY



sDA_{300lux/50%}: 100%
ASE_{1000,250}: 80.2%
Average Lux: 5783 lux



sDA_{300lux/50%}: 100%
ASE_{1000,250}: 63.6%
Average Lux: 3867 lux

PRECEDENT STUDY: Shading

Horizontal Shading



Skylight / Outdoor

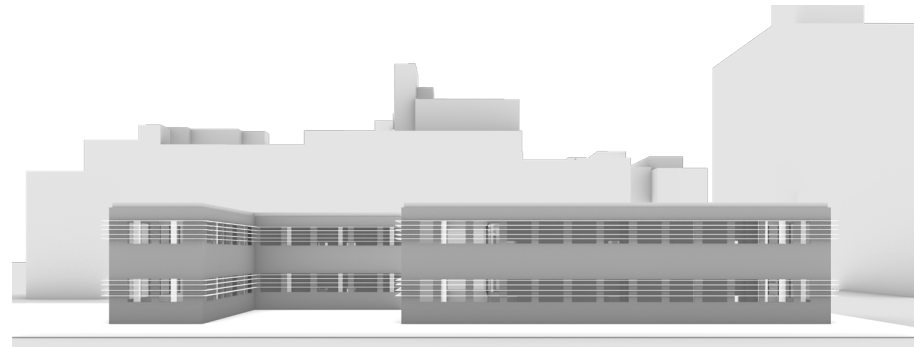
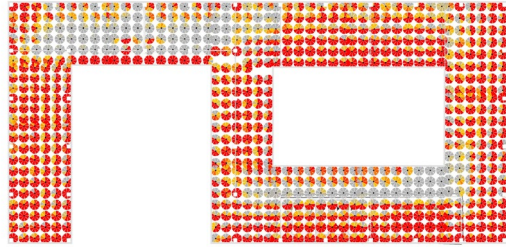
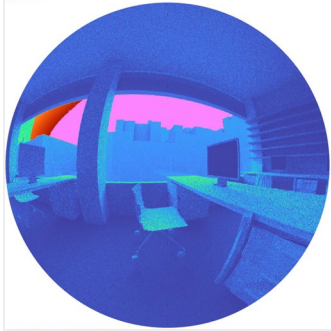


Skylight / indoor

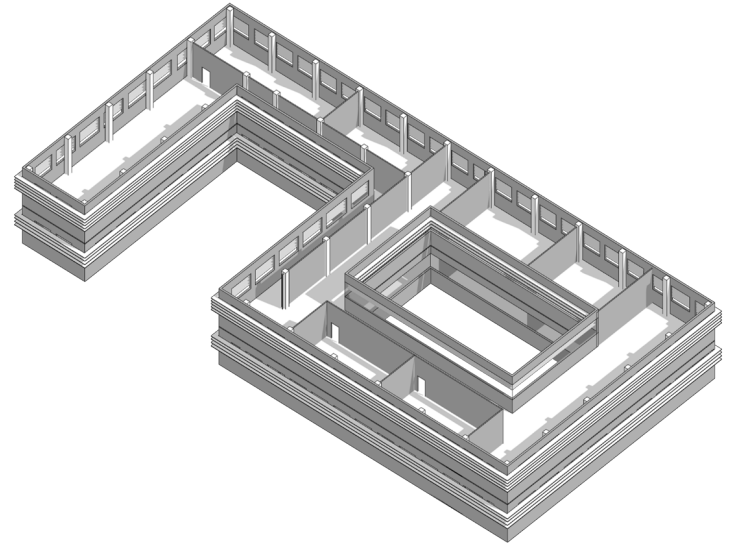
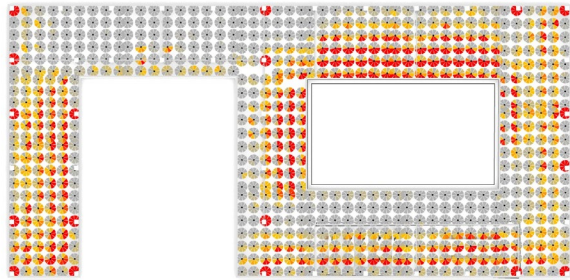


Final Design

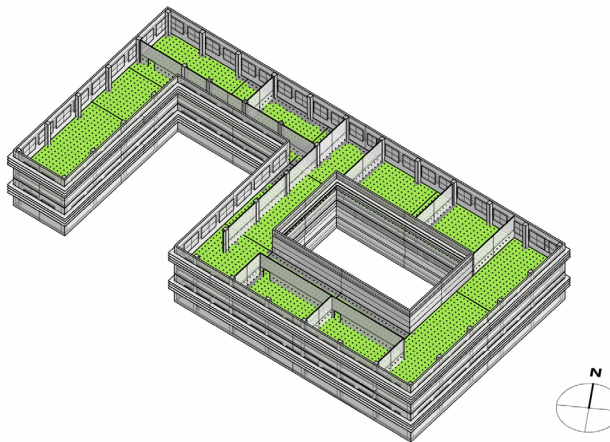
Glare Analysis: Before Shading
sDG=44.1%



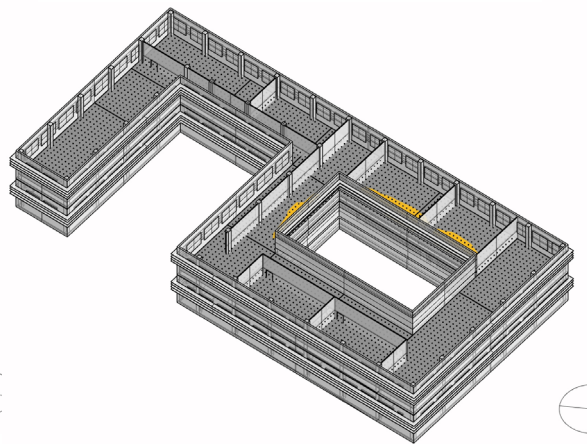
Glare Analysis: After Shading
sDG=9.5%



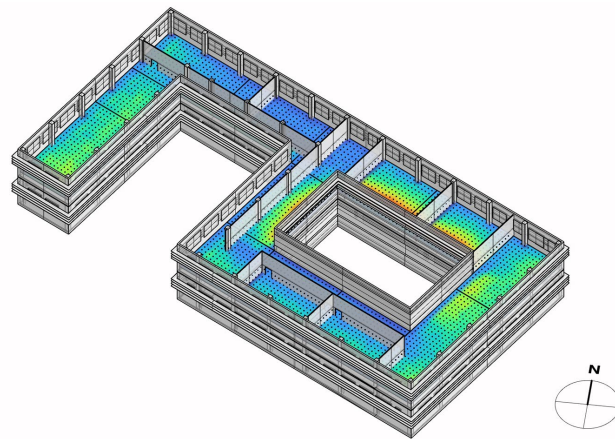
DAYLIGHTING: Visual Comfort Analysis



92.4%
sDA_{300/50%}

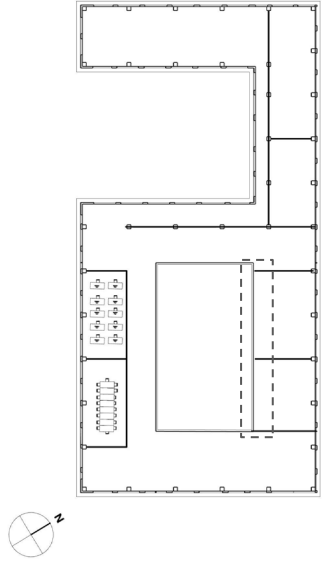


5.5%
ASE_{1000,250}


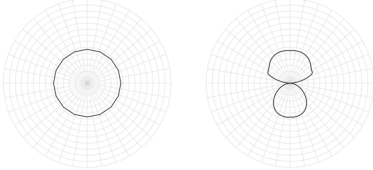
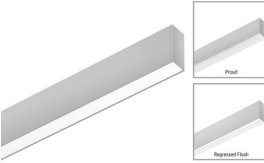
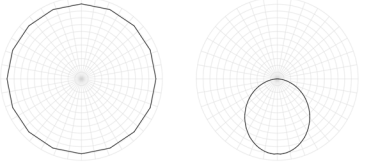


849
avg lux

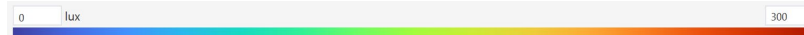
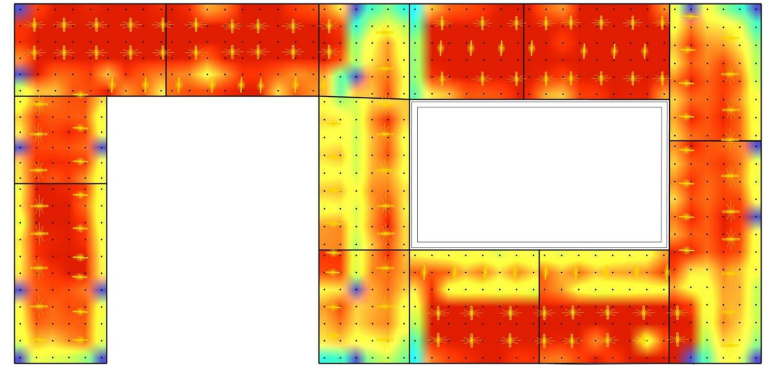
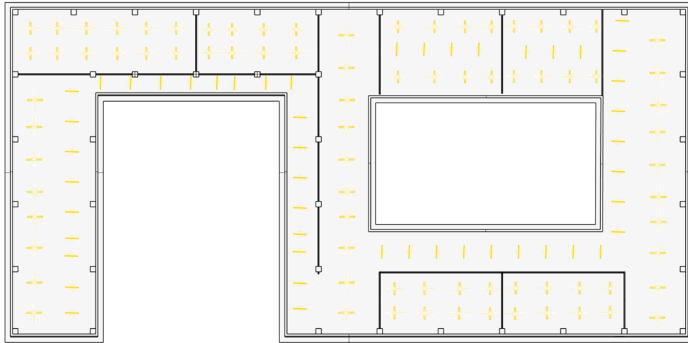
INTERIOR RENDERINGS



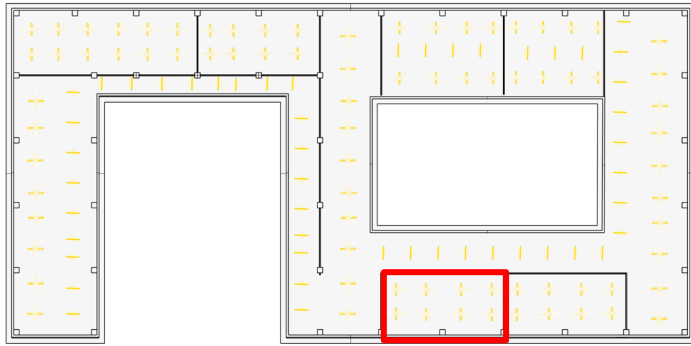
ELECTRIC LIGHTING

<p>Corelite Element E2 4' WaveStream LED Suspended 5,005 lumens Location: Office spaces</p>			<p>46.3 Watts</p>
<p>Neo-Ray Define 2" LED Surface Direct 4' Suspended 2,273 lumens Location: Circulation spaces</p>			<p>26.3 Watts</p>

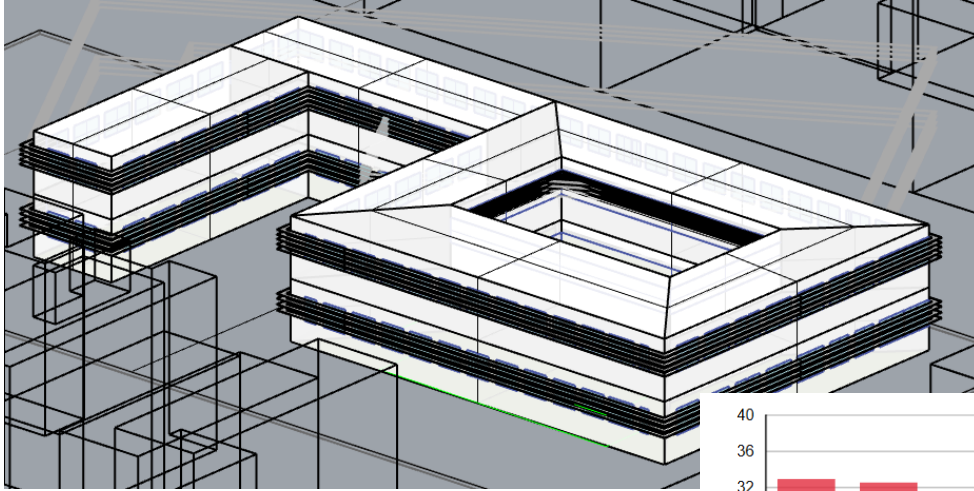
$$LPD = \frac{80(46.4) + 49(26.3)}{1171m^2} = \boxed{4.26W/m^2}$$



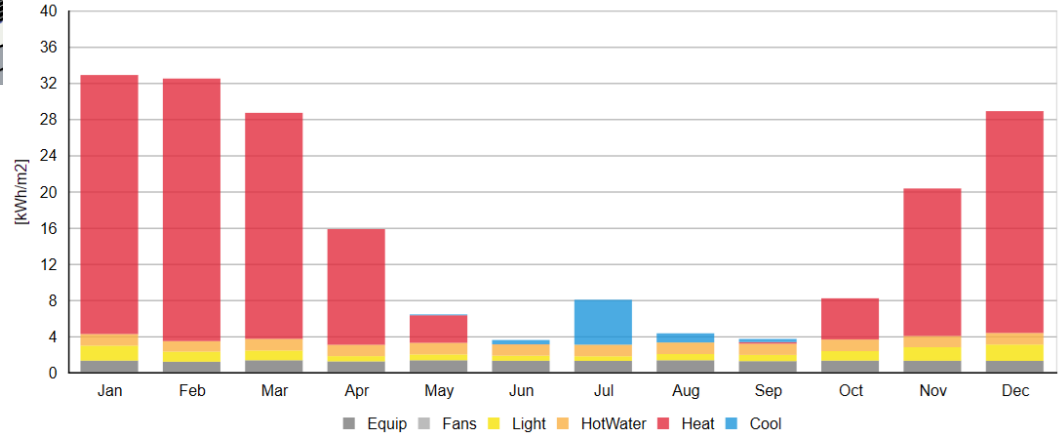
INTERIOR RENDERING



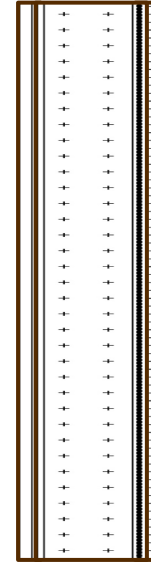
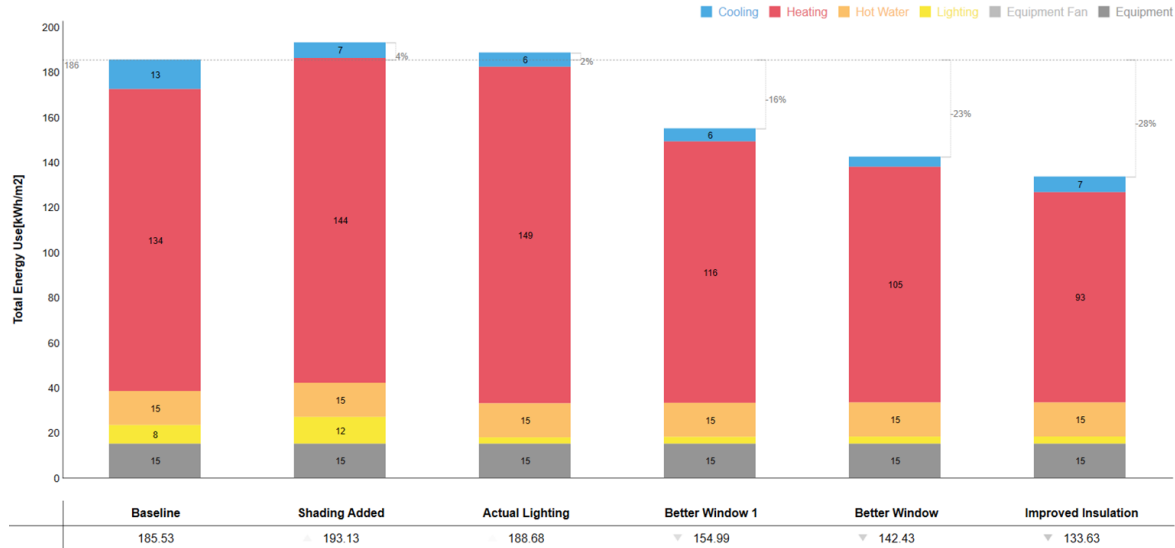
ENERGY CONCEPT - PART 1



Initial Site EUI



ENERGY CONCEPT - PART 1



Outside / Top



Inside / Bottom

OCCUPANCY / SETPOINTS

Schedules



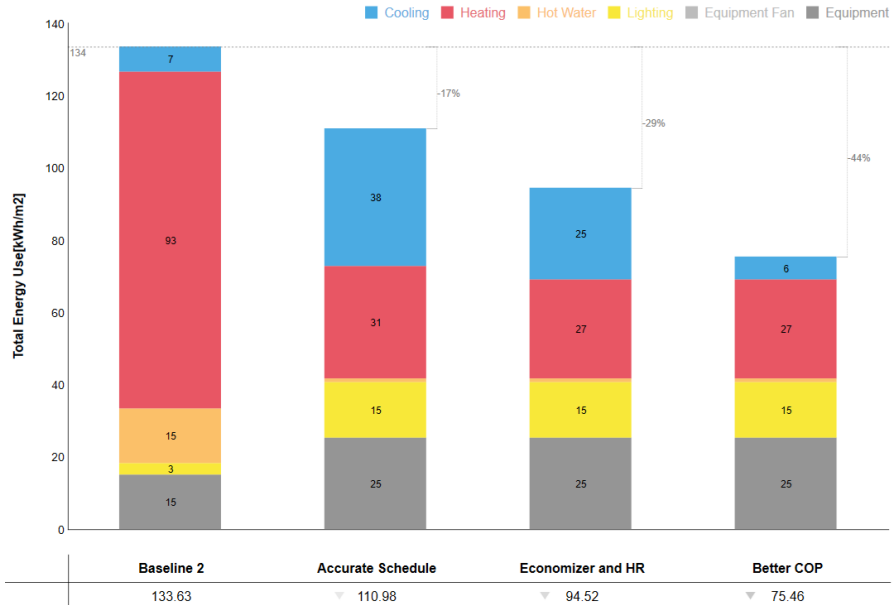
Heating

MediumOffice-4A_HTGSETP_SCH_Year	Schedule	HeatingSetpoint [C]
STARTUP_SCHEDULE		HeatingSchedule [Schedule name]
30		MaxHeatSupplyAirTemp [C]
LimitCapacity		HeatingLimitType [enum]
100		MaxHeatingCapacity [W/m2]
100		MaxHeatFlow [m3/s/m2]
1		HeatingCOP

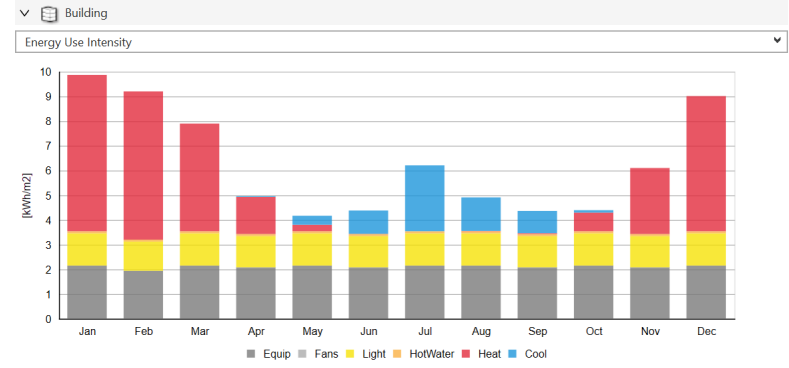
Cooling

MediumOffice-4A_CLGSETP_SCH_Year	Schedule	CoolingSetpoint [C]
STARTUP_SCHEDULE		CoolingSchedule [Schedule name]
18		MinCoolSupplyAirTemp [C]
NoLimit		CoolingLimitType [enum]
100		MaxCoolingCapacity [W/m2]
100		MaxCoolFlow [m3/s/m2]
1		CoolingCOP

ENERGY CONCEPT - PART 2



75	35	6	73%	284
Site EUI kWh/m ²	Op. Carbon kgCO ₂ /m ²	Energy Cost \$/m ²	Saved Vs. Baseline	Baseline EUI kWh/m ²



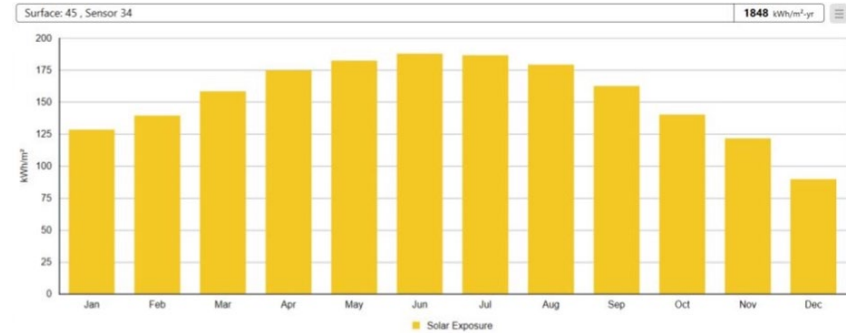
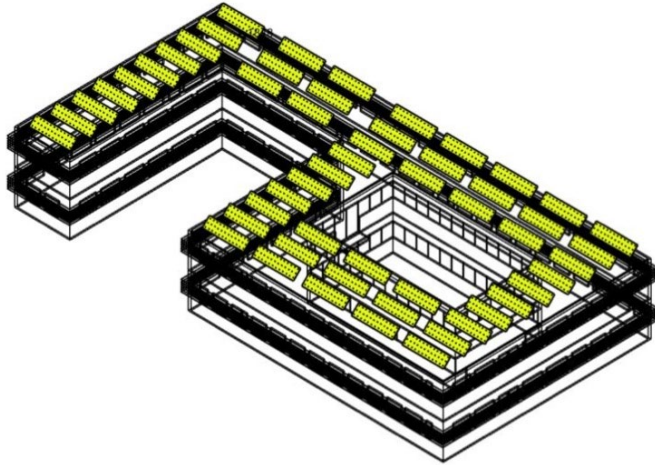
Final Energy Model

Target Site EUI: 113 kWh/m2/yr

Final Site EUI: 75 kWh/m2/yr

Simulated Energy Use: 75 kWh/m2 x 2500m2 = 187,500 kWh

ENERGY CONCEPT - PHOTOVOLTAIC



Solar Panel Energy Production:

320 (panels) x **1.5** m² x **1848** kWh/m² yr x **0.18** x **0.96** = **153280** kWh

The percentage of our simulated energy use covered by the PV system is: **81.7%** (Net EUI of 14)

Thank You!