

## TASK 1

### **Solar radiation:**

Solar Radiation in cosmos creates amazing kinds of light both visible and invisible to our eye. It is solar energy emitted by the sun. This radiant energy comes from the sun because of the nuclear fusion in its surface. It is always creating electromagnetic energy because of the nucleus fusion.

We have several kinds of waves coming from the solar radiation.

**Visible:** Short waves we see as sunlight, a combination of bright light and heat. These are two kinds of visible rays, direct and indirect or diffused sunlight. Direct sunlight is when the light is not covered by the clouds. When it is covered by clouds, we see a diffused version of the light.

**Invisible:** Infrared rays, X-rays, Gamma-rays, ultraviolet rays are invisible to the eye. The ultraviolet rays have both positive and negative effects on health of human and other animal's life. Excess rays can harm the body whereas at the same time we get vitamin from the ultraviolet ray.

This energy is either transmitted, scattered or absorbed. When solar radiation reaches earth's surface it is modified. This modification is due to the phenomenon of dispersion and absorption. Solar radiation is dependent on the position of the sun, the weather conditions, the altitude, and the duration of the day.

### **Dispersion :**

Dispersion happens when the energy of the sun is dispersed and lowers the temperature of earth's surface. The greater the dispersion is, the lower the temperature gets. And this happens when the sun rays are not perpendicular to the surface of the earth.

### **Scattering:**

Electromagnetic radiation comes from accelerating electric charges. On a molecular level, objects warm up their molecules vibrate harder and harder, causing acceleration of electric charges. Scattering is when solar radiation passes through and some of the wavelengths are deflected in all directions by gas

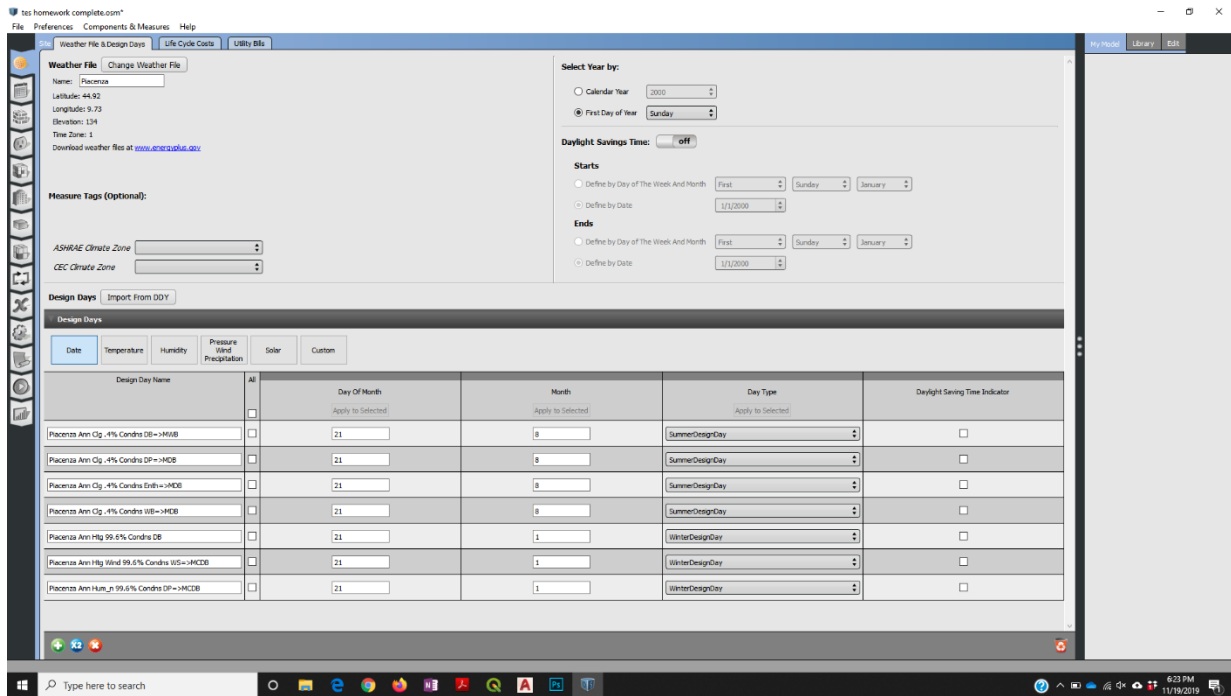
molecules, particles, and water vapor. The drama of different colors during the sunset are created by this scattering because these particles get suspended and create variety of colors,

**Reflection:**

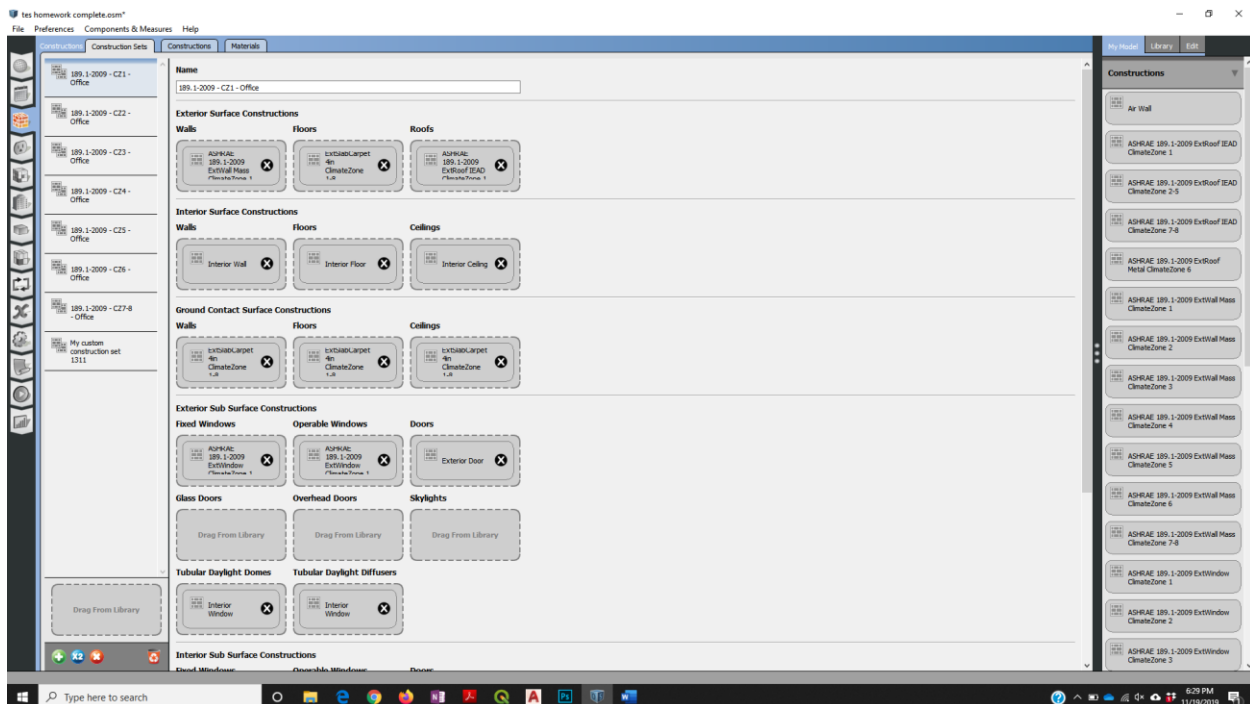
The surface also reflects some part of incident radiation as following the rules of radiation. So, that reflected radiation goes back to the medium from where it was originated. This is called reflection.

The Sun is a huge thermal reactor about 93 million miles away. In heat transfer by radiation, energy is carried by electromagnetic waves from a starting point to the space surrounding it and does not involve contact with matter. The other forms of heat transfer cannot produce any of the energy that arrives to Earth through the vacuum of space. Photons emitted from the surface of the Sun need to travel across the vacuum of space to reach our eyes. The short answer is that it takes sunlight an average of 8 minutes and 20 seconds to travel from the Sun to the Earth. So, what we see as light and colors, it's actually a past we're seeing every single day.

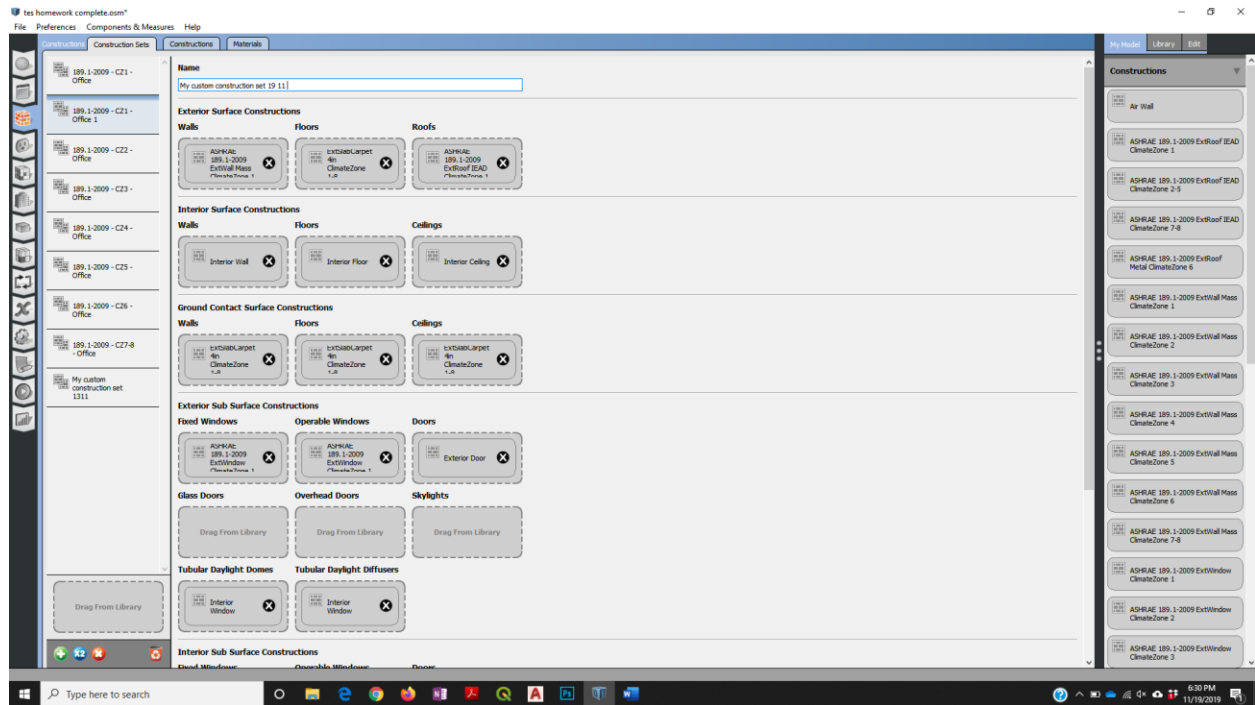
## TASK 2



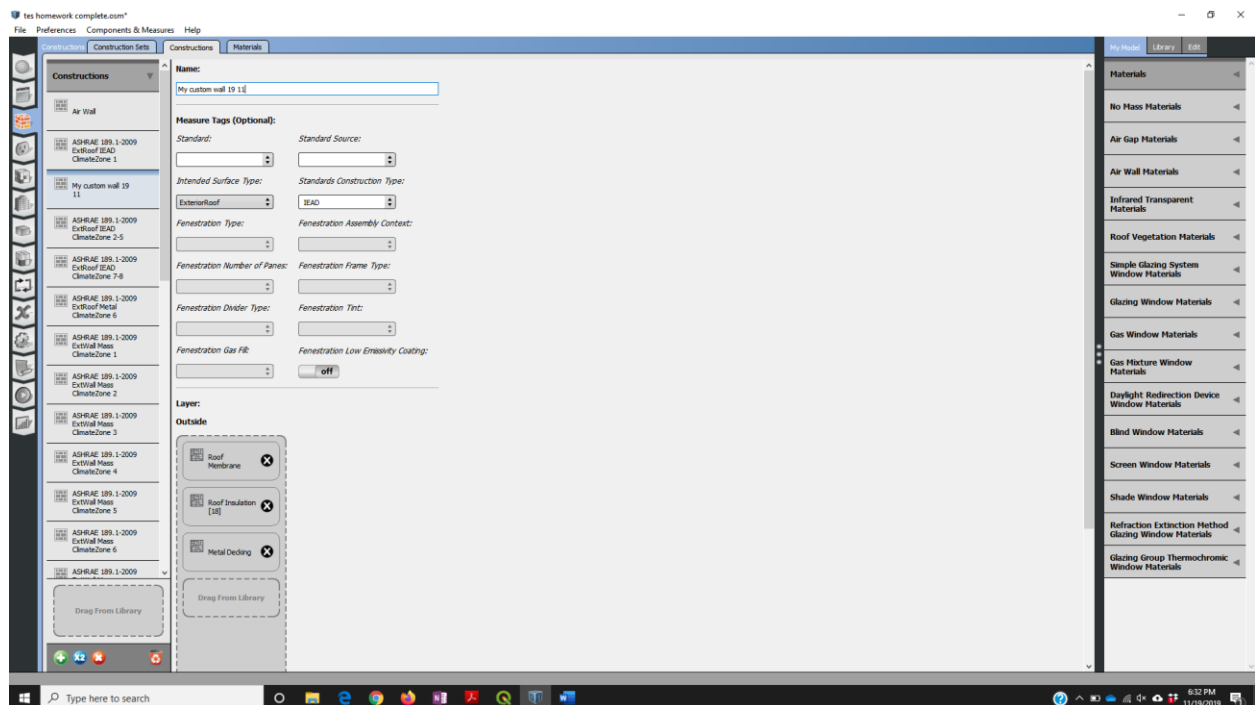
Putting the weather data, the epw and ddy file.



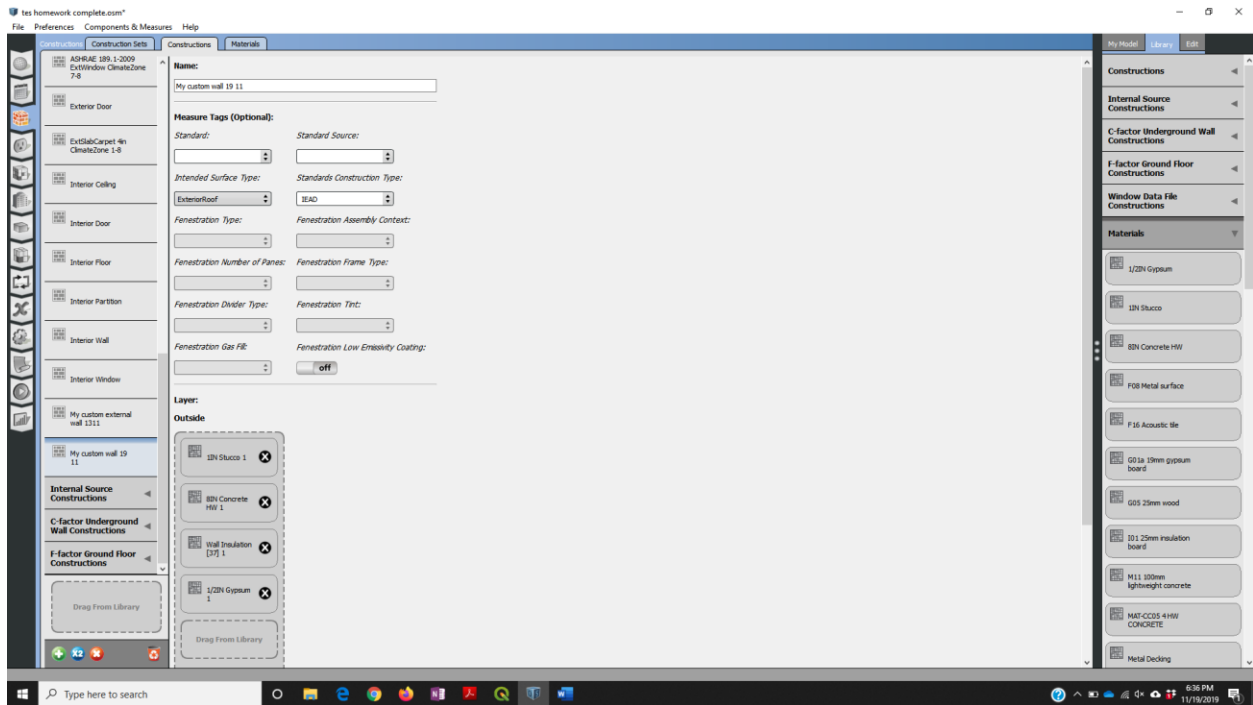
Construction sets: Clicking X2 to create a new custom construction set.



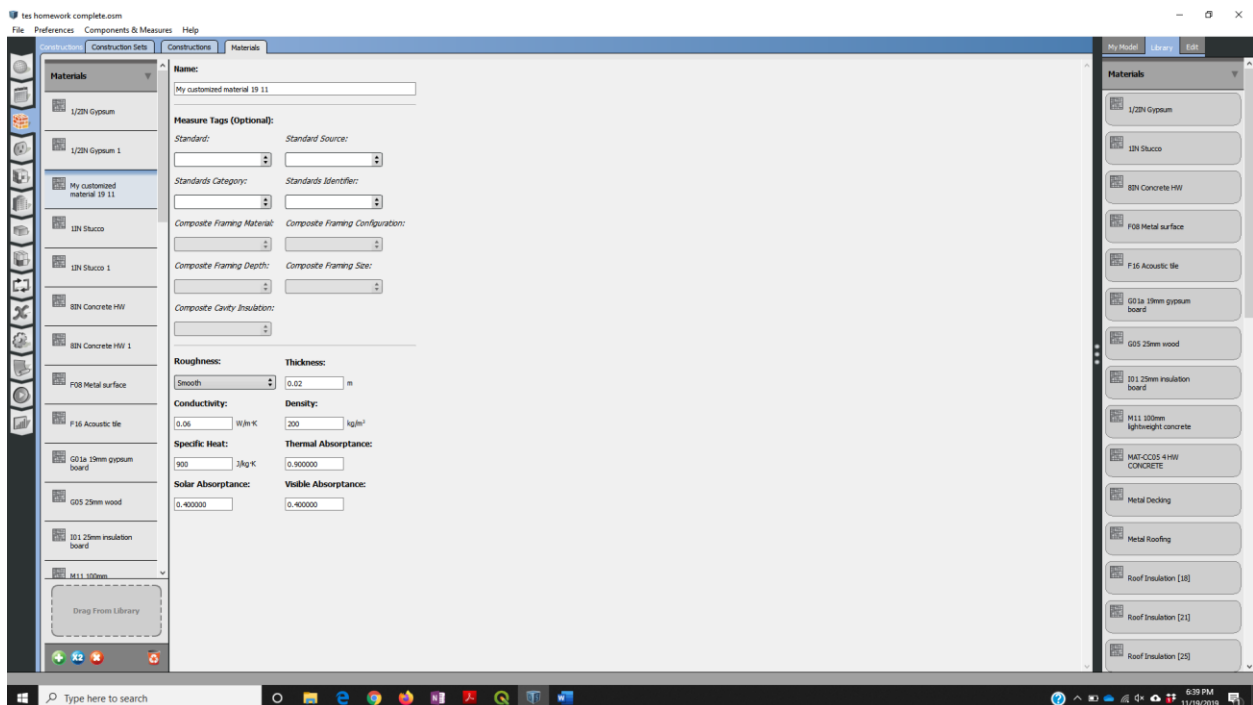
Construction sets: Clicking X2 to create a new custom construction set.



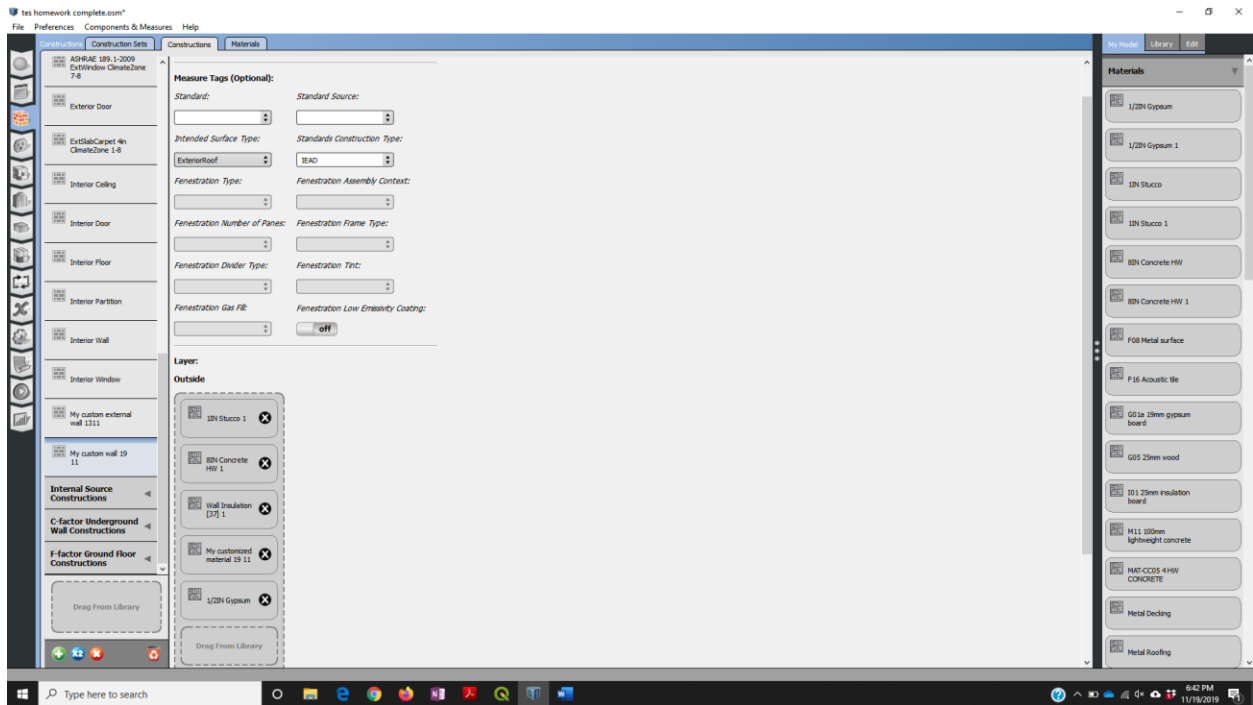
Construction: Clicking X2 to create a new custom construction wall.



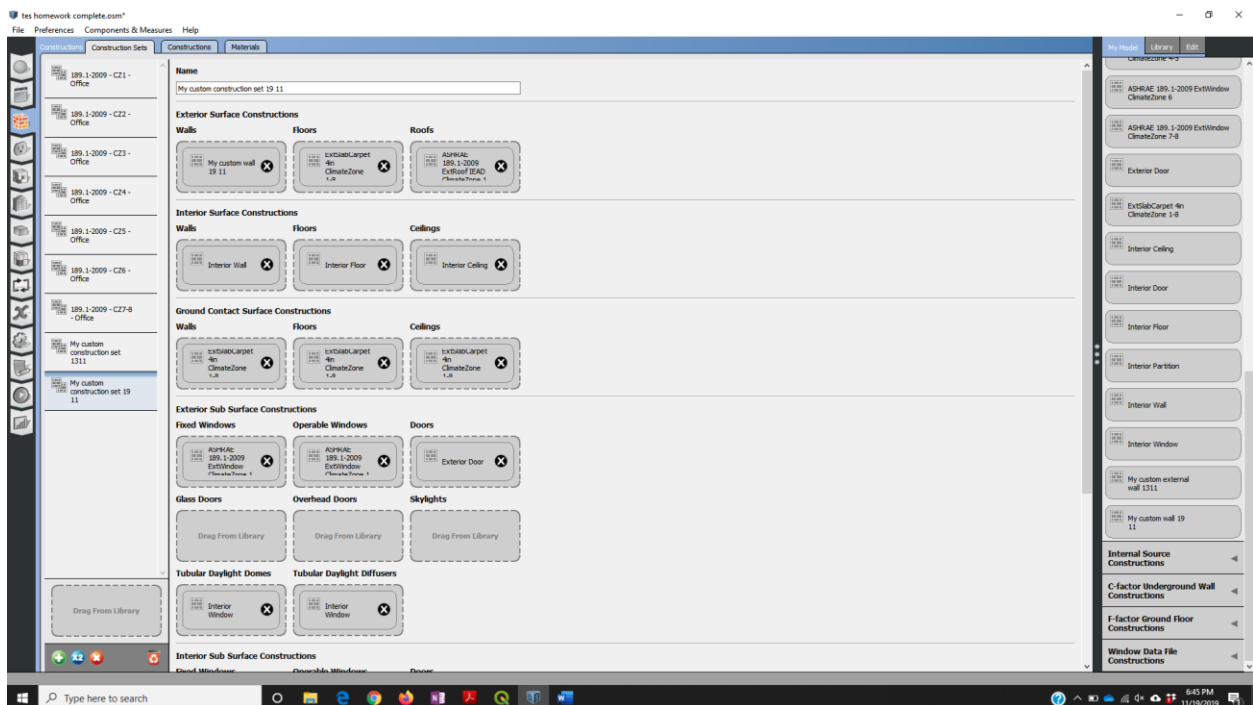
Adding new material to the custom wall.



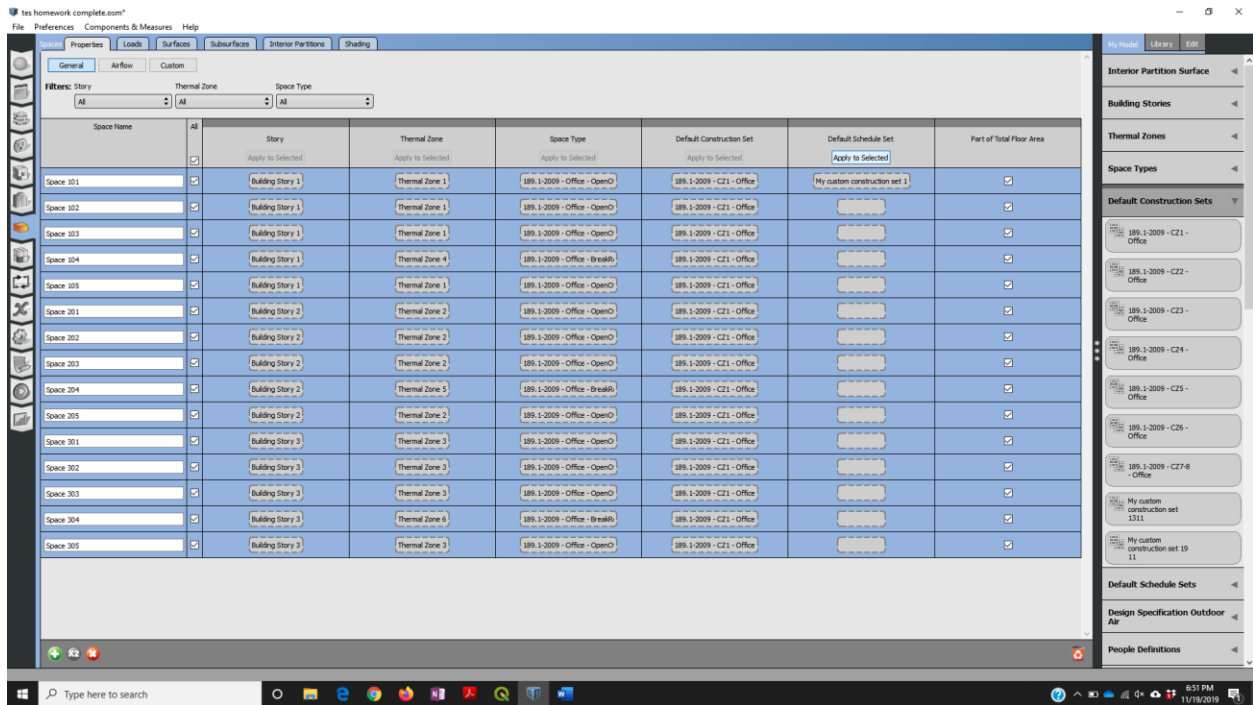
Material: Clicking X2 to create a new custom Material by changing the values of thickness, conductivity etc.



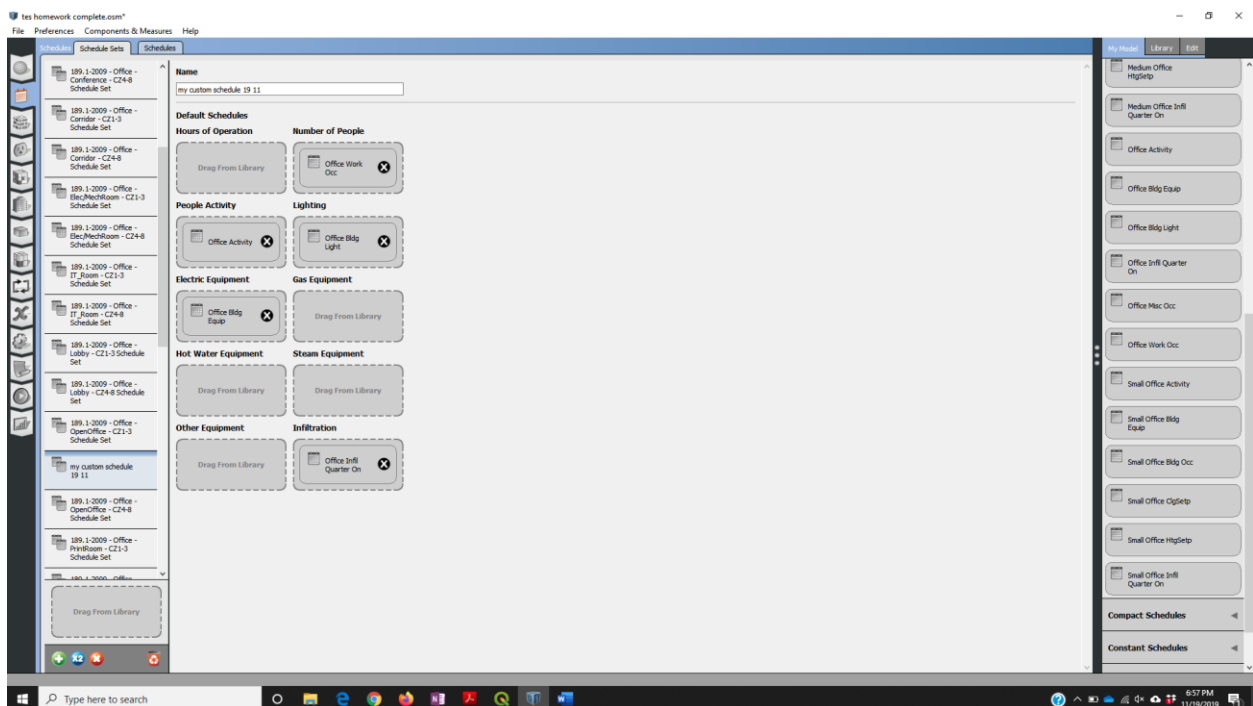
Construction: Putting the custom material in the wall material section.



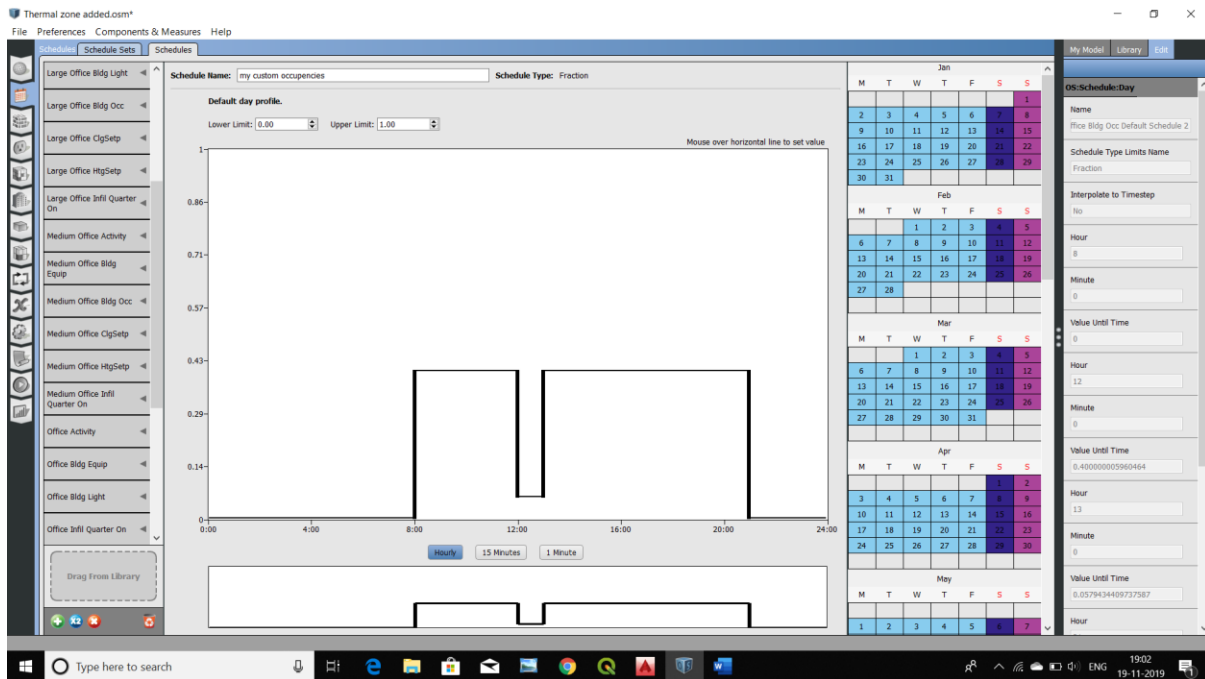
Putting the custom construction in Wall construction set.



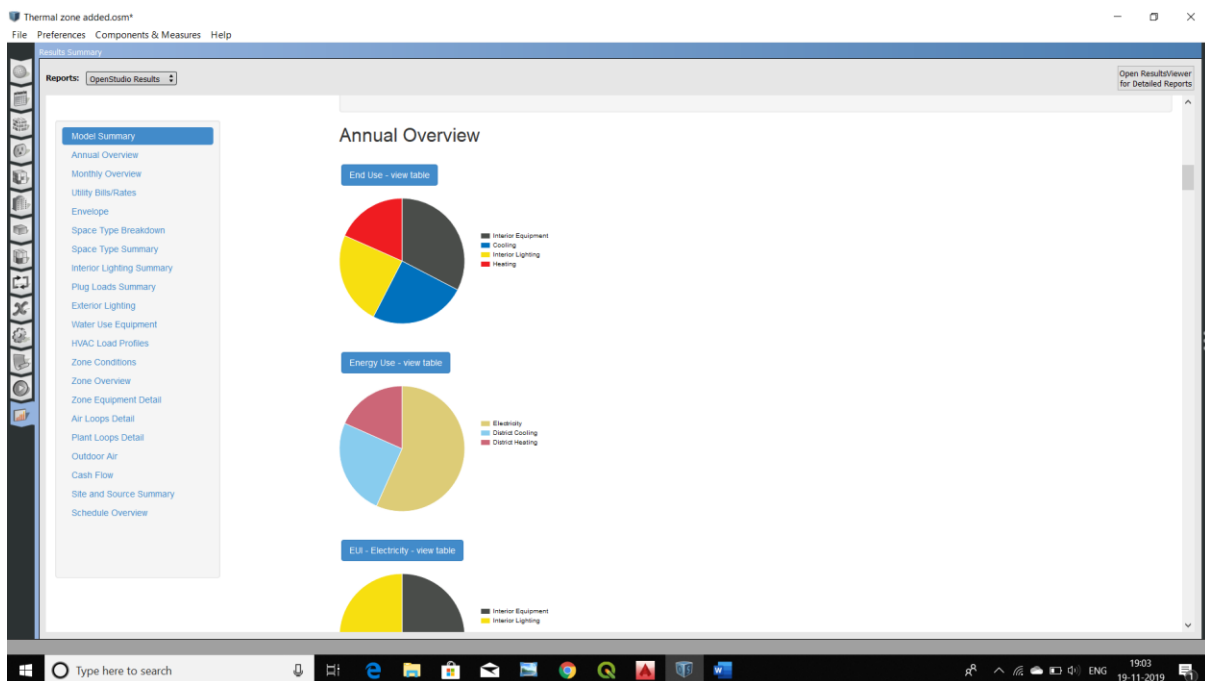
Spaces: Selecting all the spaces and apply the “Custom construction set” to all the layers.



Schedule: Creating “custom schedule set” layer by clicking X2.

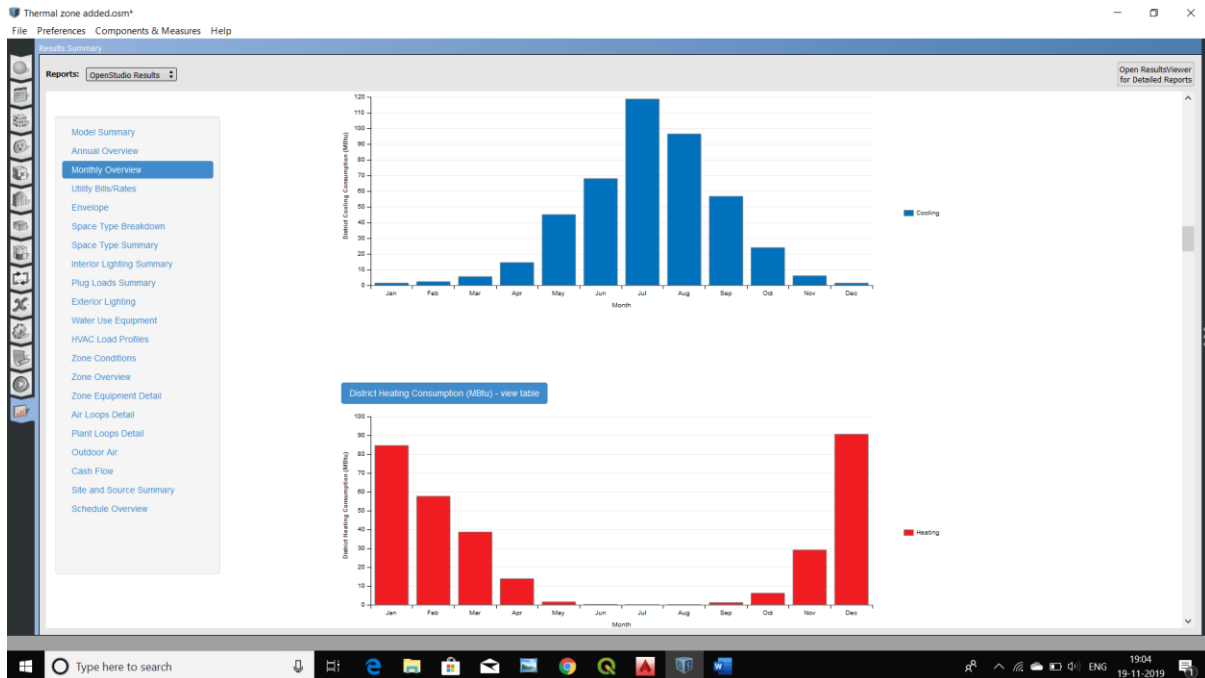
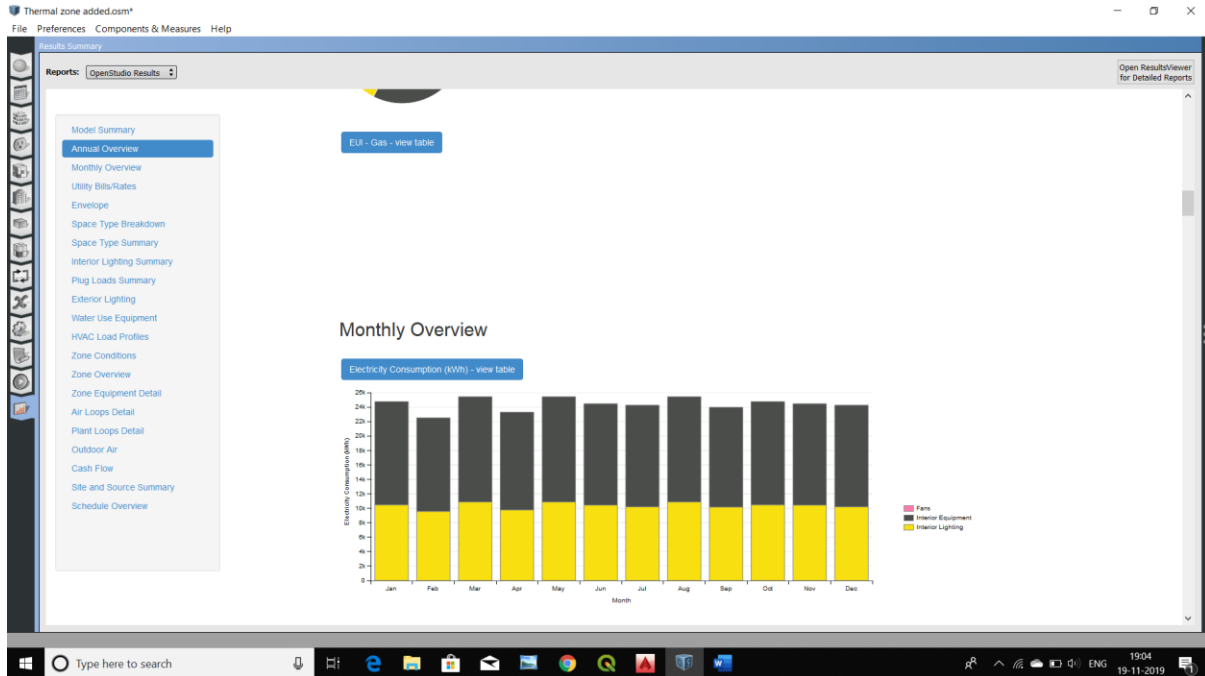


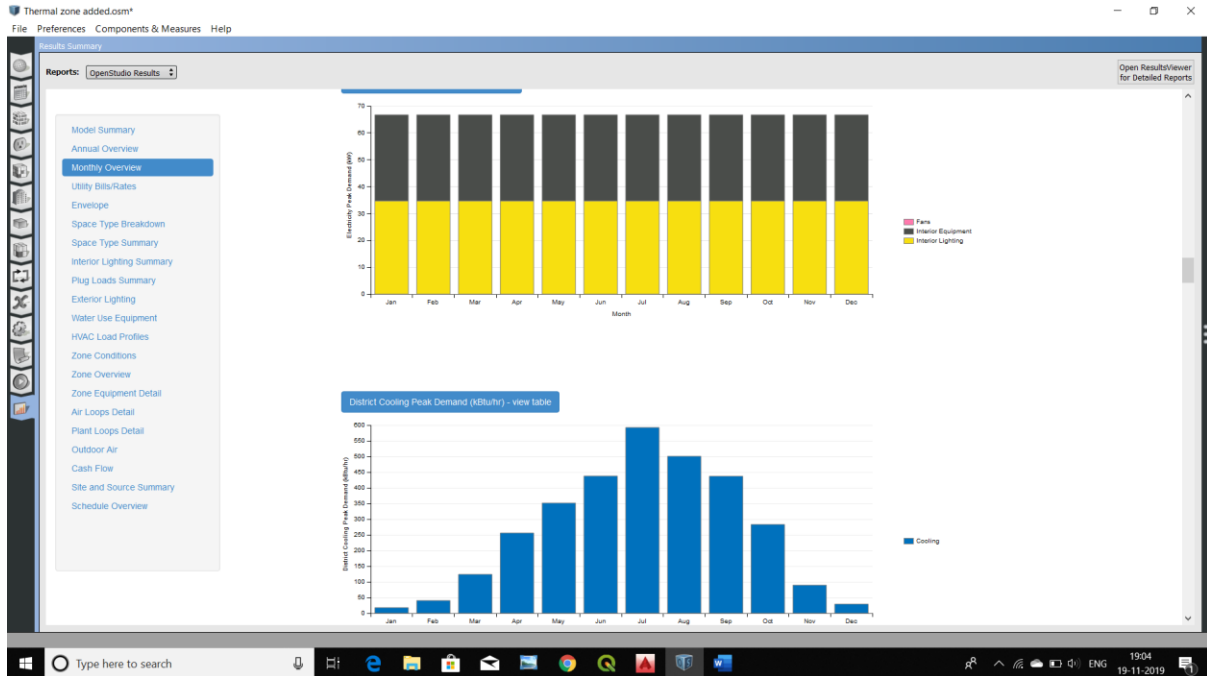
Schedule: Redesign the schedule of open office.



Running the simulation after putting the schedule in schedule sets.  
Getting the result.







Thermal zone added.com®

File Preferences Components & Measures Help

Results Summary

Reports: OpenStudio Results

Open Results/Viewer for Detailed Reports

Model Summary  
Annual Overview  
Monthly Overview  
Utility Bills/Rates  
Envelope  
Space Type Breakdown  
Space Type Summary  
Interior Lighting Summary  
Plug Loads Summary  
Exterior Lighting  
Water Use Equipment  
HVAC Load Profiles  
Zone Conditions  
Zone Overview  
Zone Equipment Detail  
Air Loops Detail  
Plant Loops Detail  
Outdoor Air  
Cash Flow  
Site and Source Summary  
Schedule Overview

### Utility Bills/Rates

No Data to Show for Utility Bills/Rates

### Envelope

#### Base Surface Constructions

Construction	Net Area (ft²)	Surface Count	R Value (ft²·h/R/Btu)
ASHRAE 189.1-2009 ExtRoof IEAD ClimateZone 1	12,917	5	19.96
ASHRAE 189.1-2009 ExtWall Mass ClimateZone 1	8,268	12	5.76

#### Sub Surface Constructions

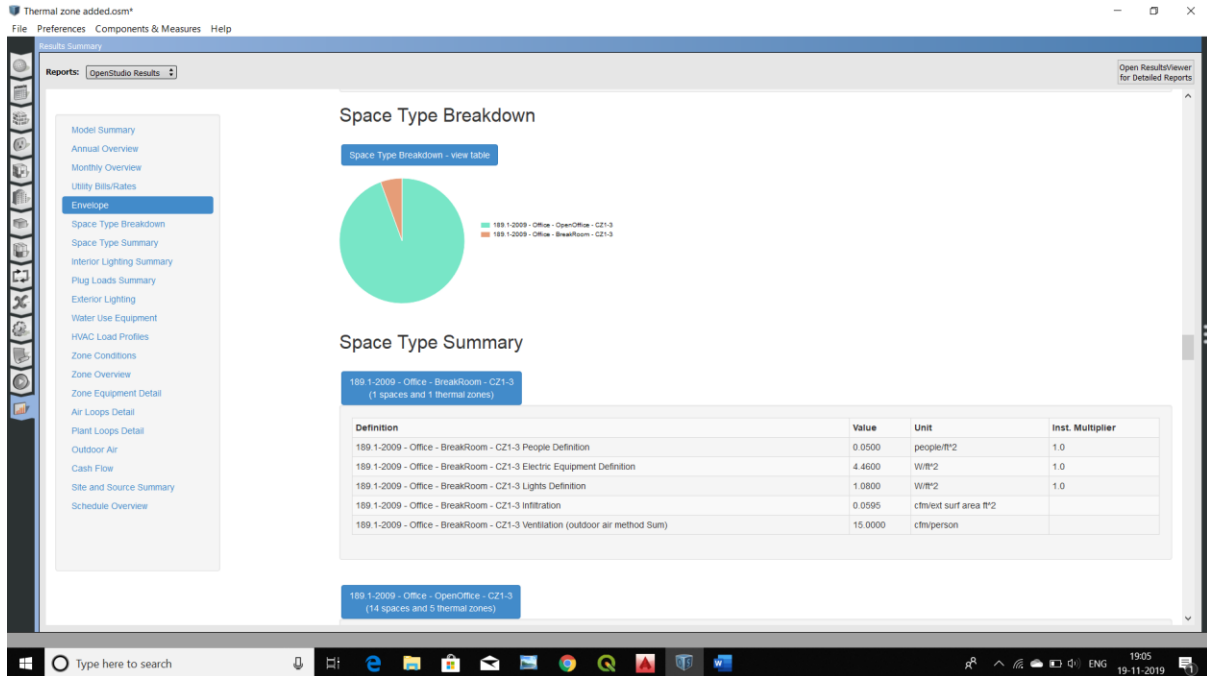
Construction	Area (ft²)	Surface Count	U-Factor (Btu/ft²·h/R)
ASHRAE 189.1-2009 ExtWindow ClimateZone 1	5,512	12	

#### WWR & Skylight Ratio

Description	Total (%)	North (%)	East (%)	South (%)	West (%)
Gross Window-Wall Ratio	40.0	40.0	40.0	40.0	40.0
Gross Window-Wall Ratio (Conditioned)	40.0	40.0	40.0	40.0	40.0
Skylight-Roof Ratio	0.0				

### Space Type Breakdown

Windows Taskbar: Type here to search, 19:05, 19-11-2019



Thermal zone added.com\*

File Preferences Components & Measures Help

Results Summary

Reports: OpenStudio Results

Open Results/Viewer for Detailed Reports

### Interior Lighting Summary

Interior Lighting Summary

	Zone	Lighting Power Density (W/m <sup>2</sup> )	Total Power (W)	Schedule Name	Scheduled Hours/Week (hr)	Actual Load Hours/Week (hr)	Return Air Fraction	Consumption (kWh)
THERMAL ZONE 2 189 1-2009 - OFFICE - BREAKROOM - CZ1-3 LIGHTS	THERMAL ZONE 2	1.08	2325.0	OFFICE BLDG LIGHT	61.85	61.85	0.0000	7497.22
THERMAL ZONE 1 189 1-2009 - OFFICE - OPENOFFICE - CZ1-3 LIGHTS	THERMAL ZONE 1	0.99	10656.27	OFFICE BLDG LIGHT	61.85	61.85	0.0000	34369.45
THERMAL ZONE 3 189 1-2009 - OFFICE - OPENOFFICE - CZ1-3 LIGHTS	THERMAL ZONE 3	0.99	10656.27	OFFICE BLDG LIGHT	61.85	61.85	0.0000	34369.45
THERMAL ZONE 4 189 1-2009 - OFFICE - OPENOFFICE - CZ1-3 LIGHTS	THERMAL ZONE 4	0.99	2131.25	OFFICE BLDG LIGHT	61.85	61.85	0.0000	6875.0
THERMAL ZONE 5 189 1-2009 - OFFICE - OPENOFFICE - CZ1-3 LIGHTS	THERMAL ZONE 5	0.99	10656.27	OFFICE BLDG LIGHT	61.85	61.85	0.0000	34369.45
THERMAL ZONE 6 189 1-2009 - OFFICE - OPENOFFICE - CZ1-3 LIGHTS	THERMAL ZONE 6	0.99	2131.25	OFFICE BLDG LIGHT	61.85	61.85	0.0000	6875.0

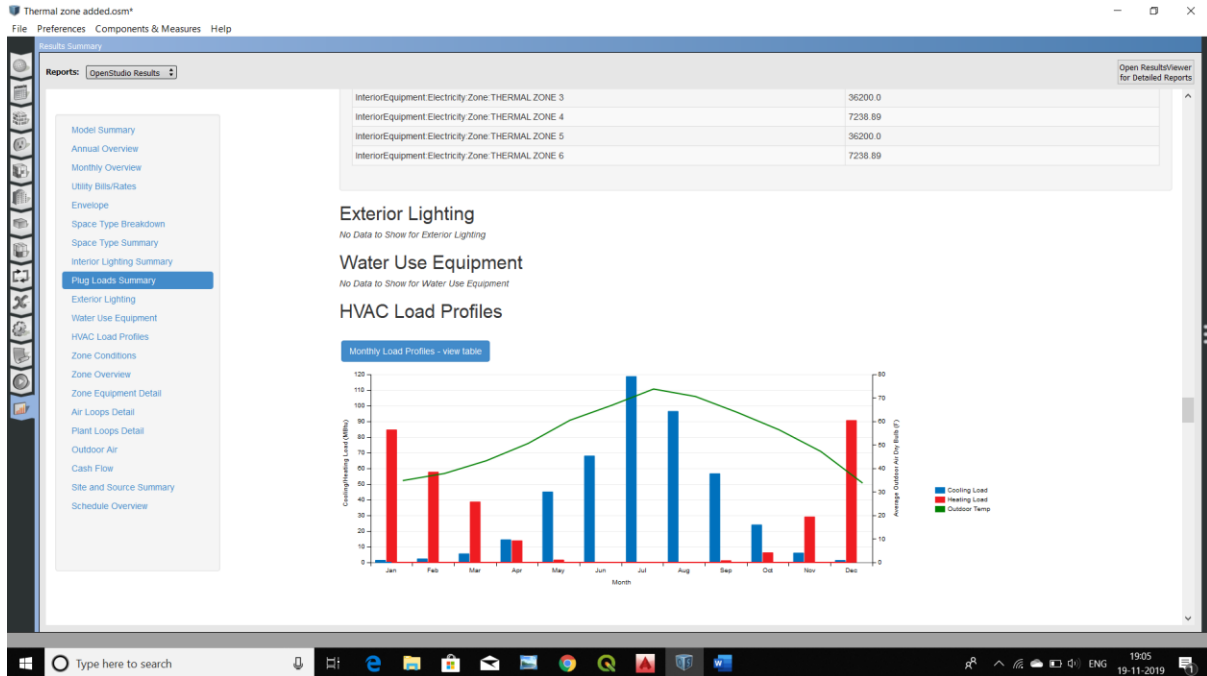
### Plug Loads Summary

Electric Plug Load Consumption

	Electricity Annual Value (kWh)
InteriorEquipment Electricity Zone THERMAL ZONE 2	45477.78
InteriorEquipment Electricity Zone THERMAL ZONE 1	36200.0
InteriorEquipment Electricity Zone THERMAL ZONE 3	36200.0
InteriorEquipment Electricity Zone THERMAL ZONE 4	7238.89
InteriorEquipment Electricity Zone THERMAL ZONE 5	36200.0
InteriorEquipment Electricity Zone THERMAL ZONE 6	7238.89

Type here to search

1905 19-11-2019



Thermal zone added.com\*

File Preferences Components & Measures Help

Results Summary

Reports: OpenStudio Results

Model Summary  
Annual Overview  
Monthly Overview  
Utility Bills/Rates  
Envelope  
Space Type Breakdown  
Space Type Summary  
Interior Lighting Summary  
Plug Loads Summary  
Water Use Equipment  
**HVAC Load Profiles**  
Zone Conditions  
Zone Overview  
Zone Equipment Detail  
Air Loops Detail  
Plant Loops Detail  
Outdoor Air  
Cash Flow  
Site and Source Summary  
Schedule Overview

Zone Conditions

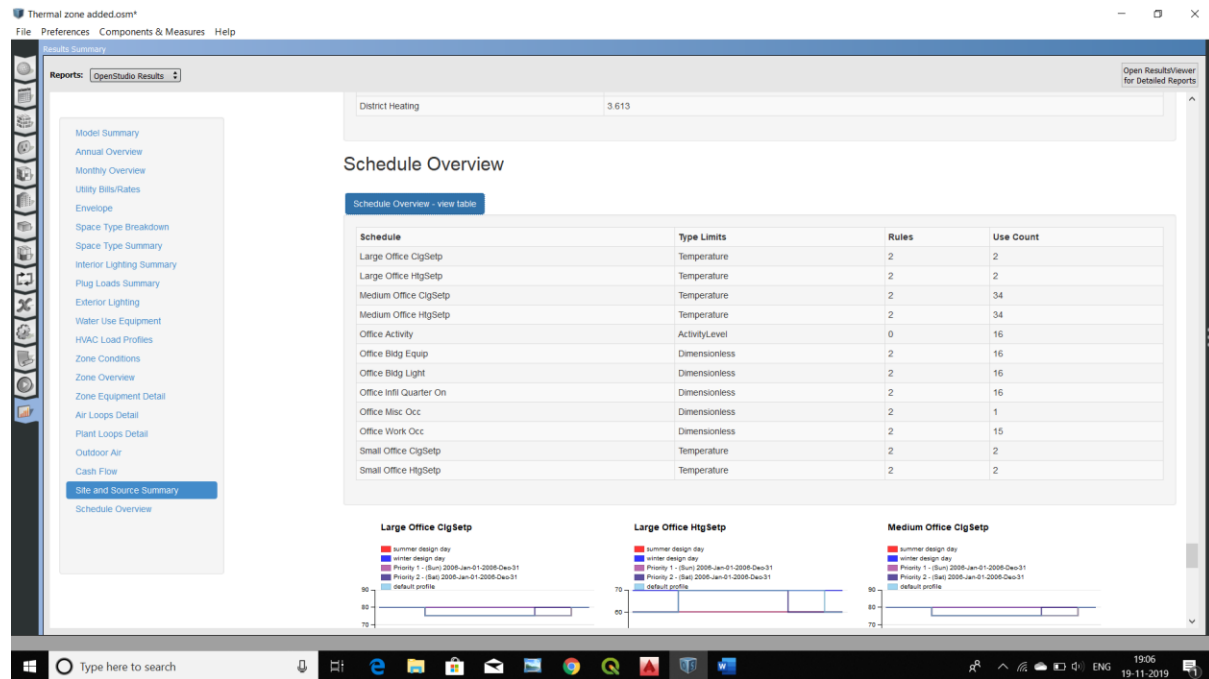
Temperature (Table values represent hours spent in each temperature range)

Zone	Unmet Htg (hr)	Unmet Htg - Occ (hr)	< 56 (°F)	56-61 (°F)	61-66 (°F)	66-68 (°F)	68-70 (°F)	70-72 (°F)	72-74 (°F)	74-76 (°F)	76-78 (°F)	78-83 (°F)	>= 88 (°F)	Unmet Clg (hr)	Unmet Clg - Occ (hr)	Mean Temp (°F)
THERMAL_ZONE 1	0	0	0	940	1117	529	2363	1309	770	1732	0	0	0	0	0	69.2 (°F)
THERMAL_ZONE 2	0	0	0	0	0	0	10	115	892	5382	1489	872	0	0	0	75.6 (°F)
THERMAL_ZONE 3	0	0	0	1036	754	277	1954	859	730	2600	333	217	0	0	0	70.4 (°F)
THERMAL_ZONE 4	0	0	0	0	307	254	661	1095	1278	3864	826	355	0	0	0	73.6 (°F)
THERMAL_ZONE 5	0	0	0	1543	523	213	2178	782	567	2406	253	295	0	0	0	69.9 (°F)
THERMAL_ZONE 6	0	0	0	546	934	239	1272	1052	767	3113	404	433	0	0	0	71.5 (°F)

Humidity (Table values represent hours spent in each humidity range)

Zone	< 30 (%)	30-35 (%)	35-40 (%)	40-45 (%)	45-50 (%)	50-55 (%)	55-60 (%)	60-65 (%)	65-70 (%)	70-75 (%)	>= 80 (%)	Mean Relative Humidity (%)
THERMAL_ZONE 1	848	832	811	817	967	973	999	934	666	378	274	50.5 (%)
THERMAL_ZONE 2	490	980	1278	1797	2097	1154	482	368	132	9	3	44.4 (%)
THERMAL_ZONE 3	846	860	835	1199	1842	1450	1024	570	122	12	0	45.5 (%)
THERMAL_ZONE 4	639	908	1188	2251	2601	673	173	74	2	0	0	42.5 (%)
THERMAL_ZONE 5	1150	923	830	1066	1607	1178	965	631	308	105	7	45.2 (%)
THERMAL_ZONE 6	1214	1087	1057	1255	2030	1078	612	296	98	23	0	42.7 (%)

Windows Taskbar: Type here to search, 1906, 19-11-2019



The FINAL RESULT.