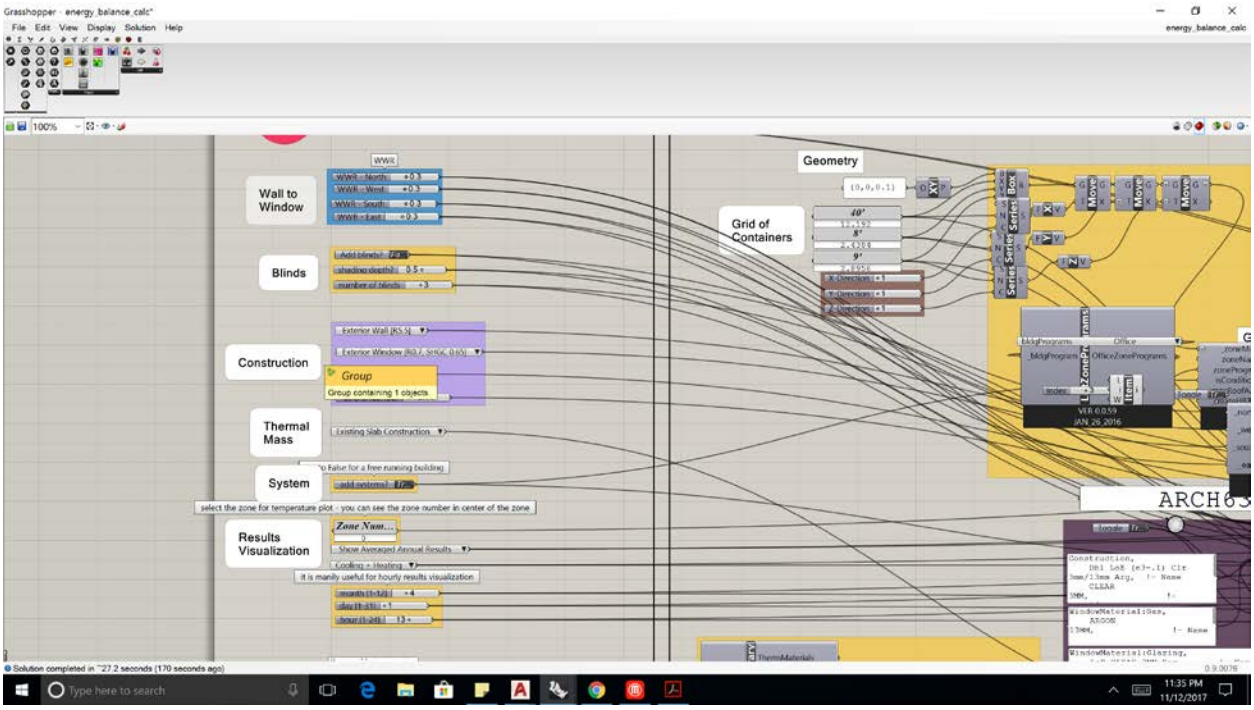
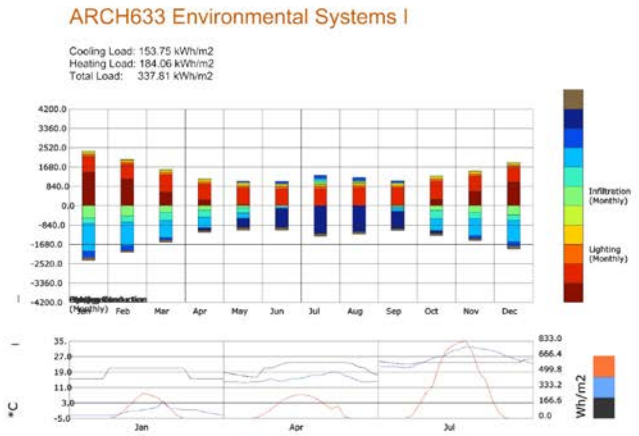
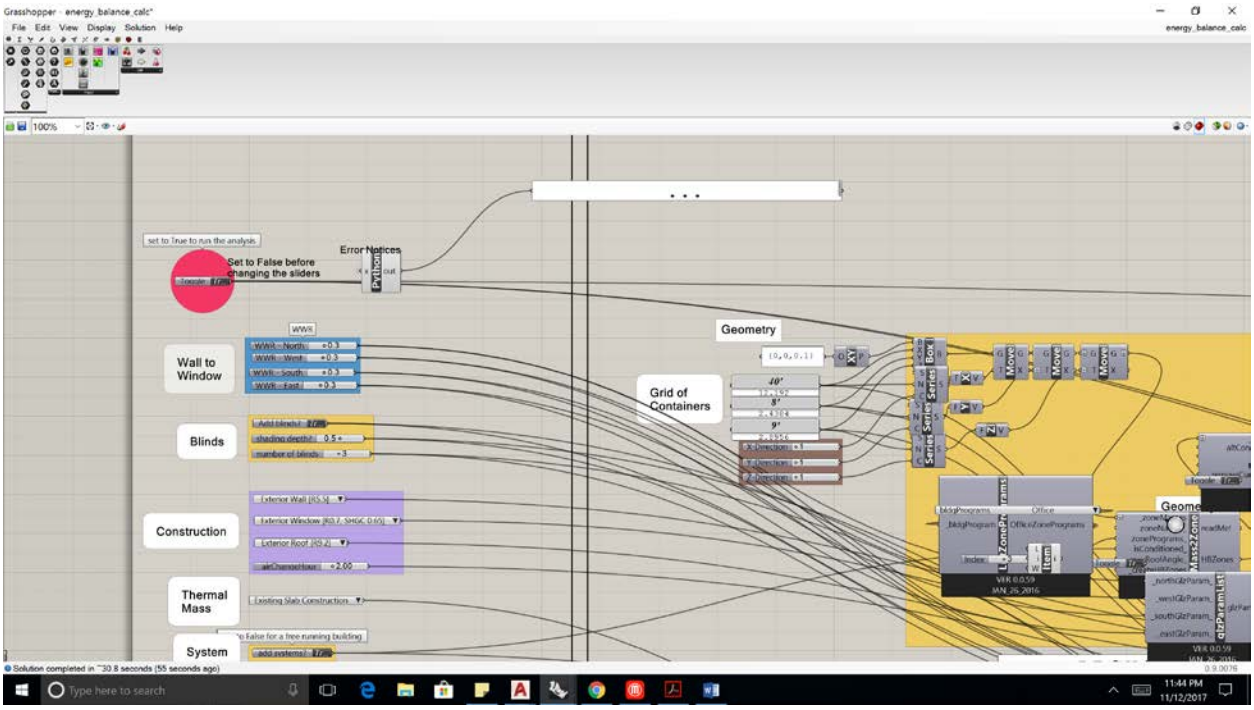
Assignment 10: Energy Load (Questions Answered on page 8)

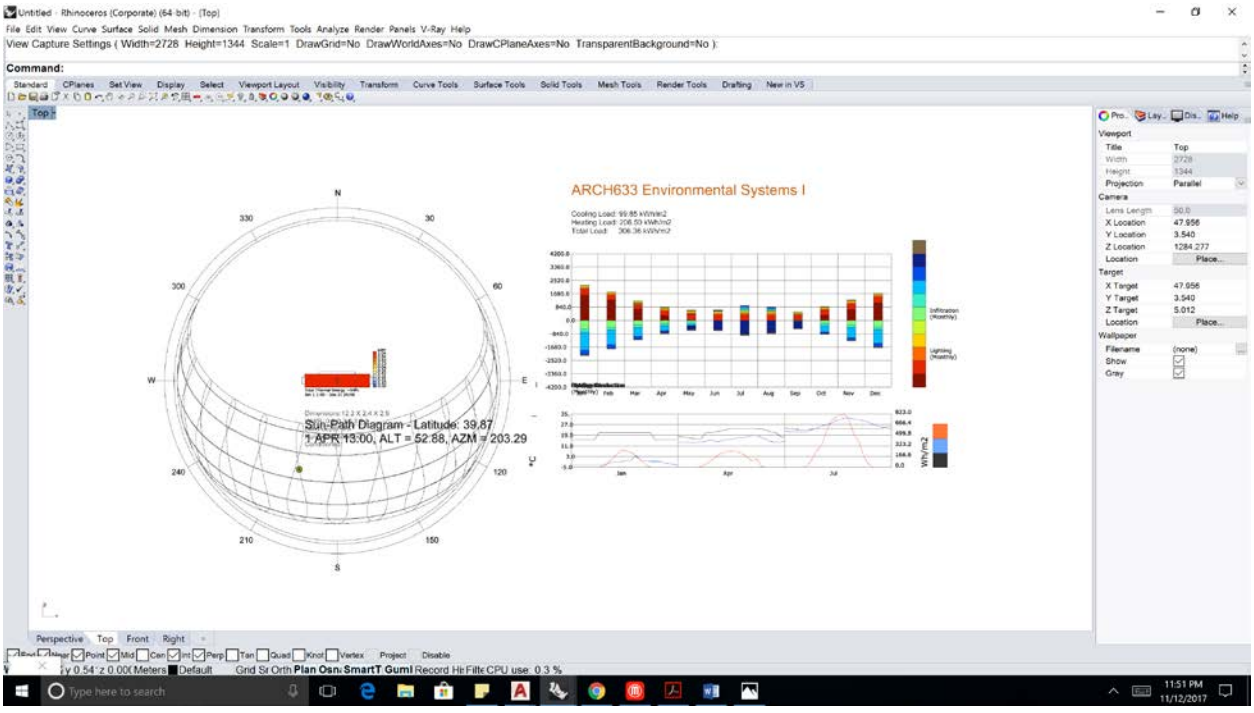
Justine Huang

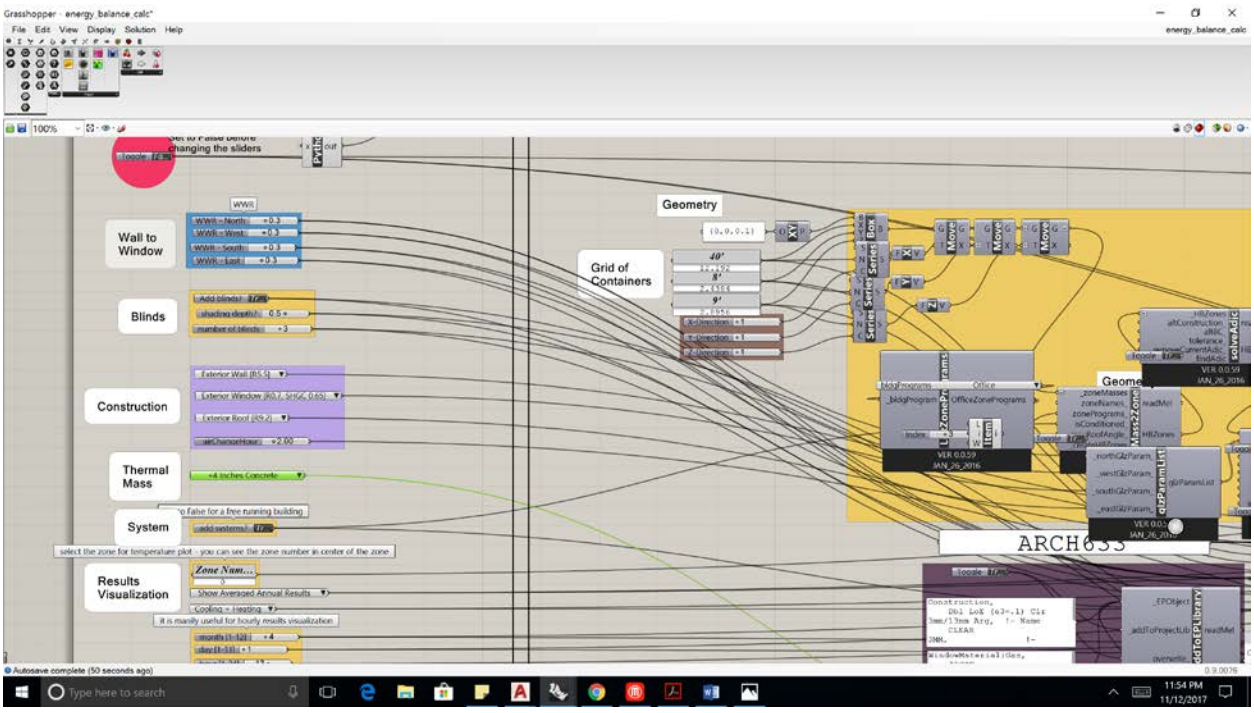


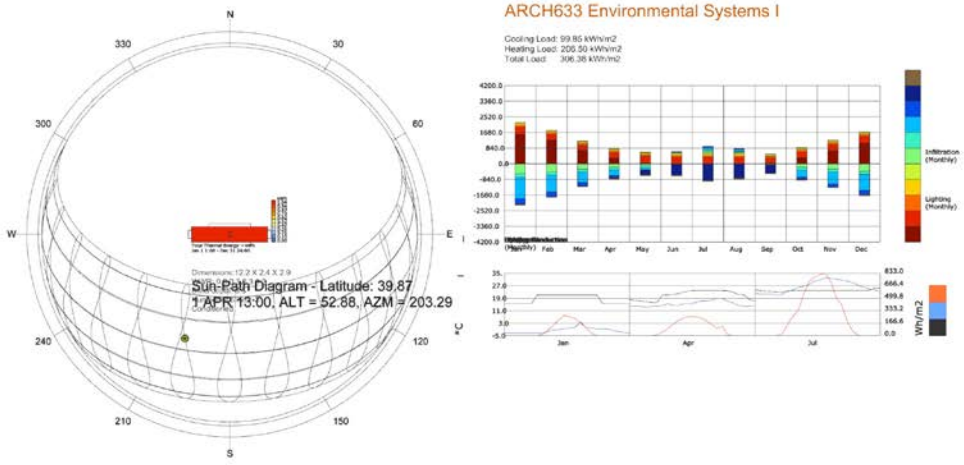
Dimensions:12.2 X 2.4 X 2.9
WWR: 0.3 0.3 0.3 0.3
Blind depth: No Blinds
Number of blinds: No Blinds
Conditioned

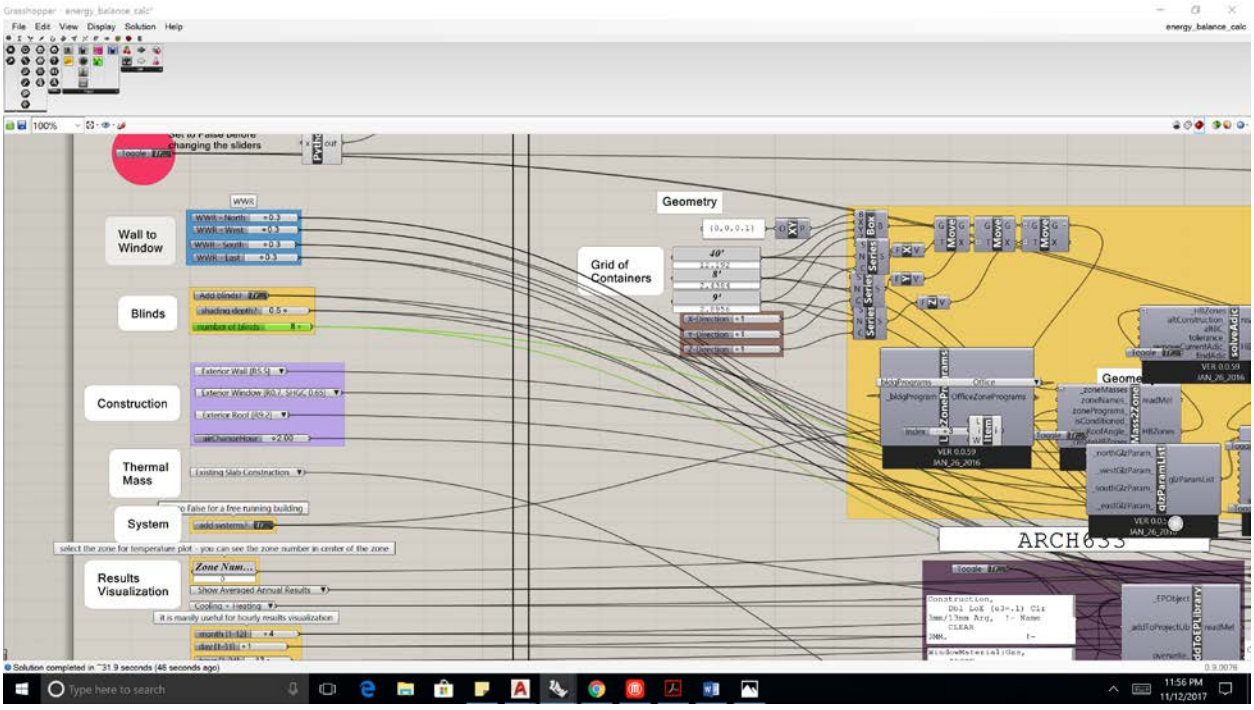


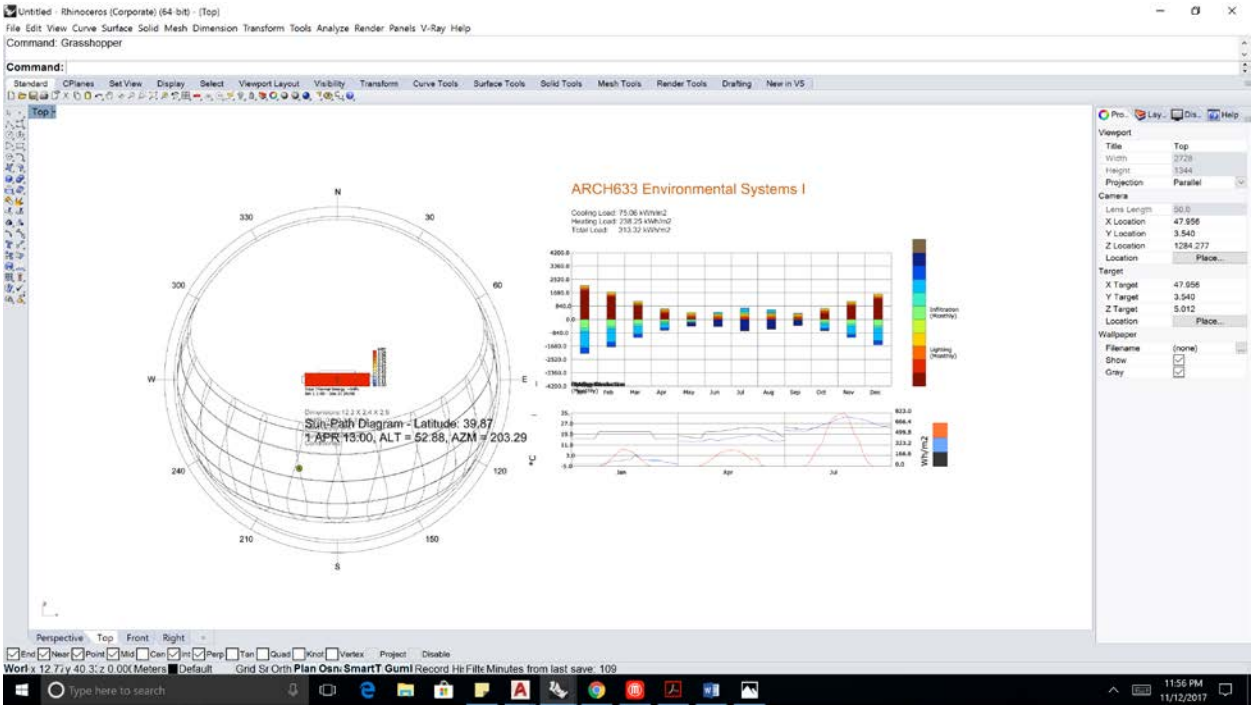

Grasshopper - energy_balance_calc*
File Edit View Display Solution Help
energy_balance_calc
set to True to run the analysis
Set to False before changing the sliders
Error Notices
Wall to Window
WWR
Blinds
Construction
Thermal Mass
System
Geometry
Grid of Containers
Solution completed in ~30.8 seconds (55 seconds ago)
Type here to search
11:44 PM
11/12/2017

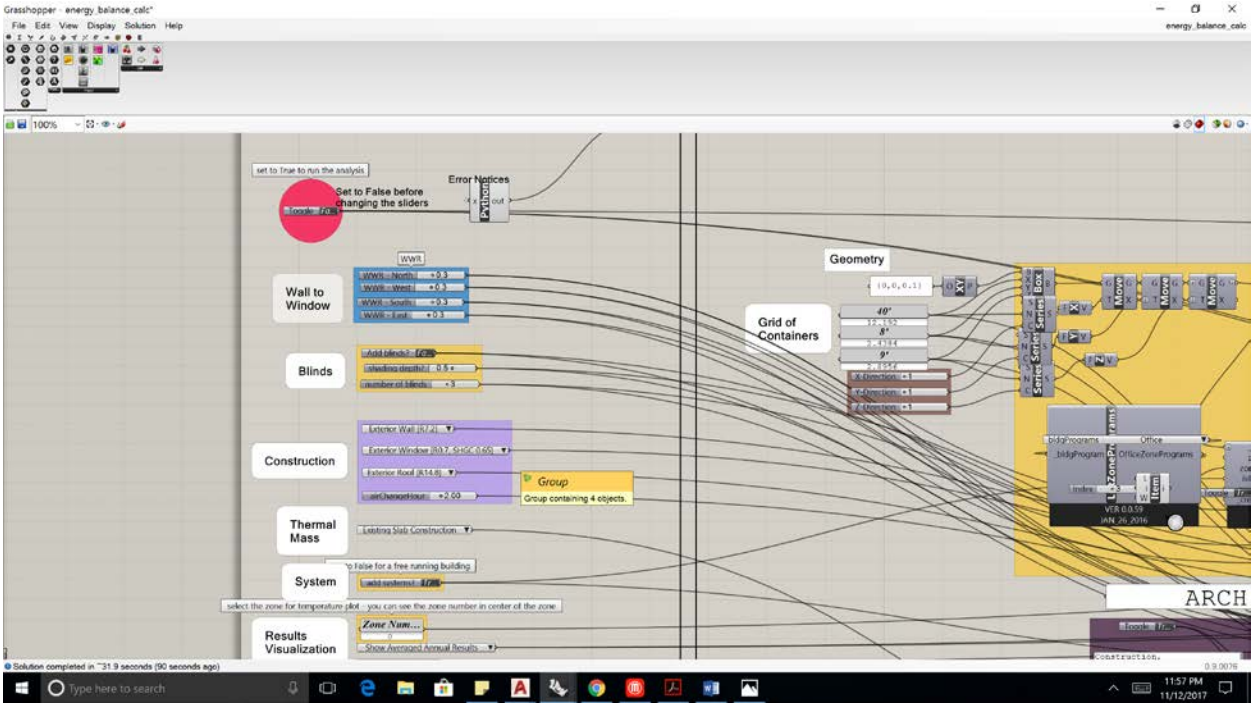

Untitled - Rhinoceros (Corporate) (64-bit) - [Top]
File Edit View Curve Surface Solid Mesh Dimension Transform Tools Analyze Render Panels V-Ray Help
Command:
ARCH633 Environmental Systems I
Sun-Path Diagram - Latitude: 39.87
1 APR 13:00, ALT = 52.88, AZM = 203.29
Perspective Top Front Right
Type here to search
11:51 PM
11/12/2017

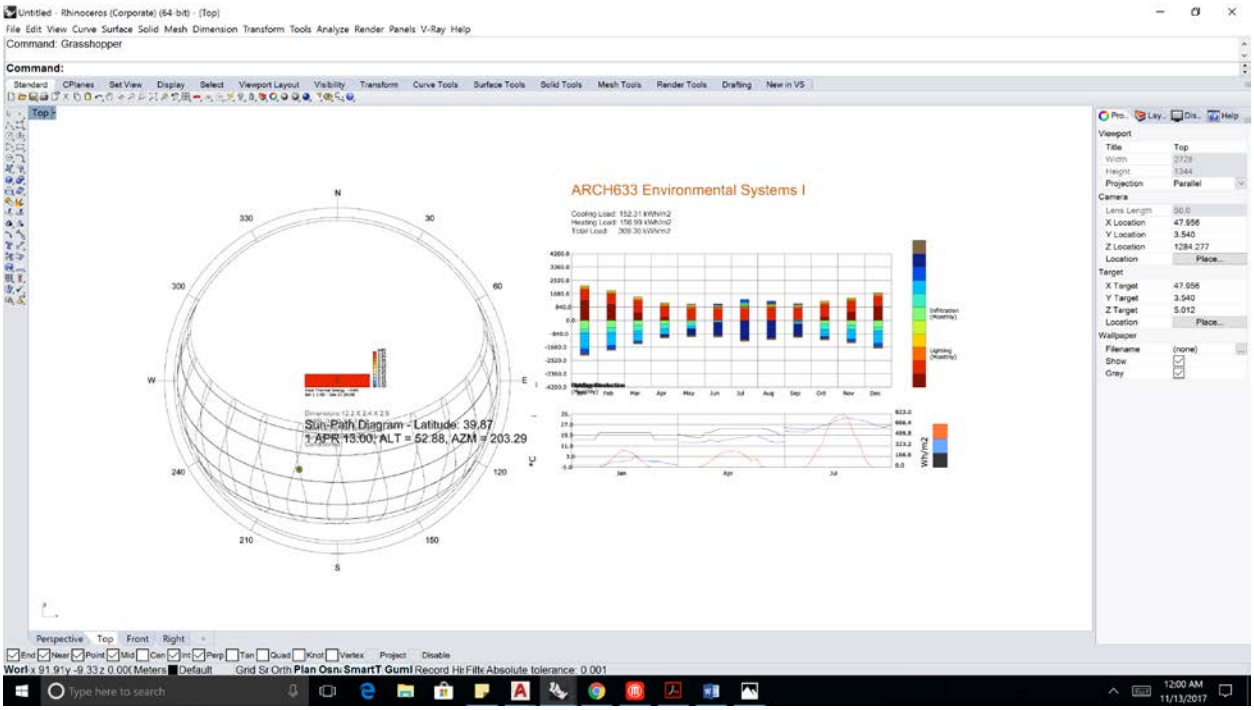

Grasshopper - energy_balance_calc*
File Edit View Display Solution Help
energy_balance_calc
Wall to Window
Blinds
Construction
Thermal Mass
System
Results Visualization
Geometry
Grid of Containers
ARCH633
Autosave complete (50 seconds ago)
Type here to search
11:54 PM
11/12/2017

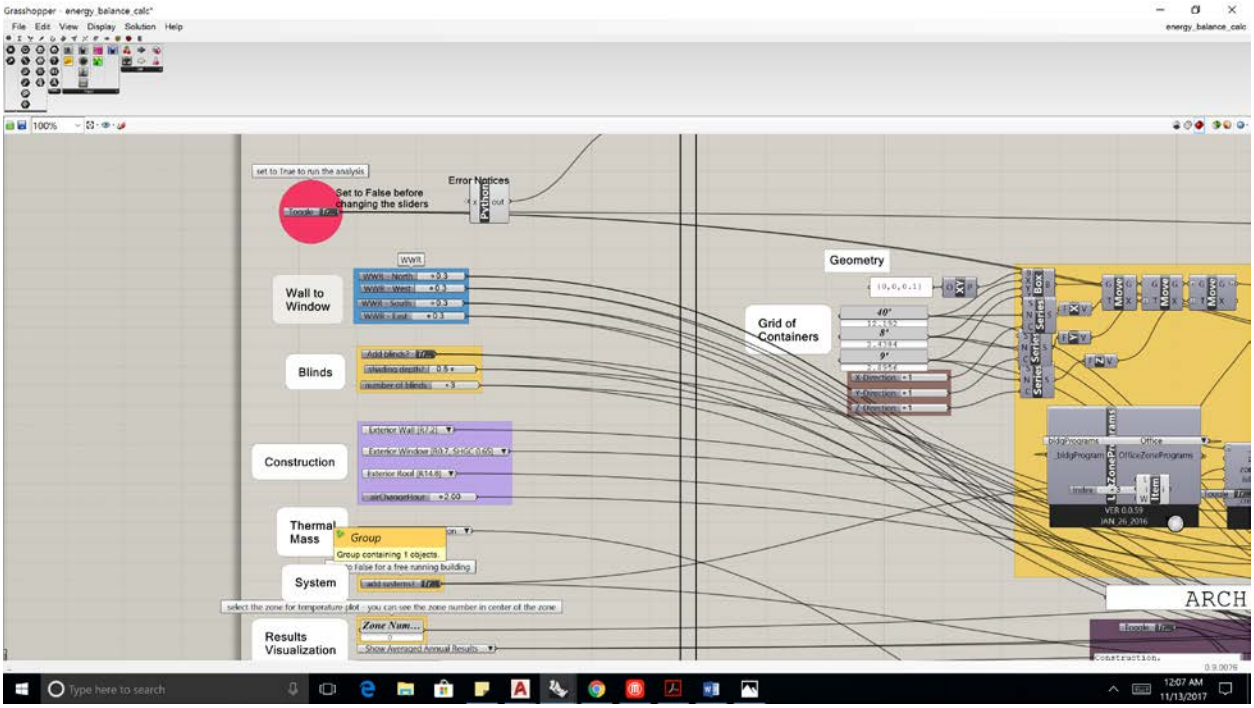

ARCH633 Environmental Systems I
Cooling Load: 99.86 kWh/m2
Heating Load: 206.50 kWh/m2
Total Load: 306.36 kWh/m2
Sun-Path Diagram - Latitude: 39.87
1 APR 13:00, ALT = 52.88, AZM = 203.29
N
E
S
W
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Infiltration (Monthly)
Lighting (Monthly)
Wh/m2

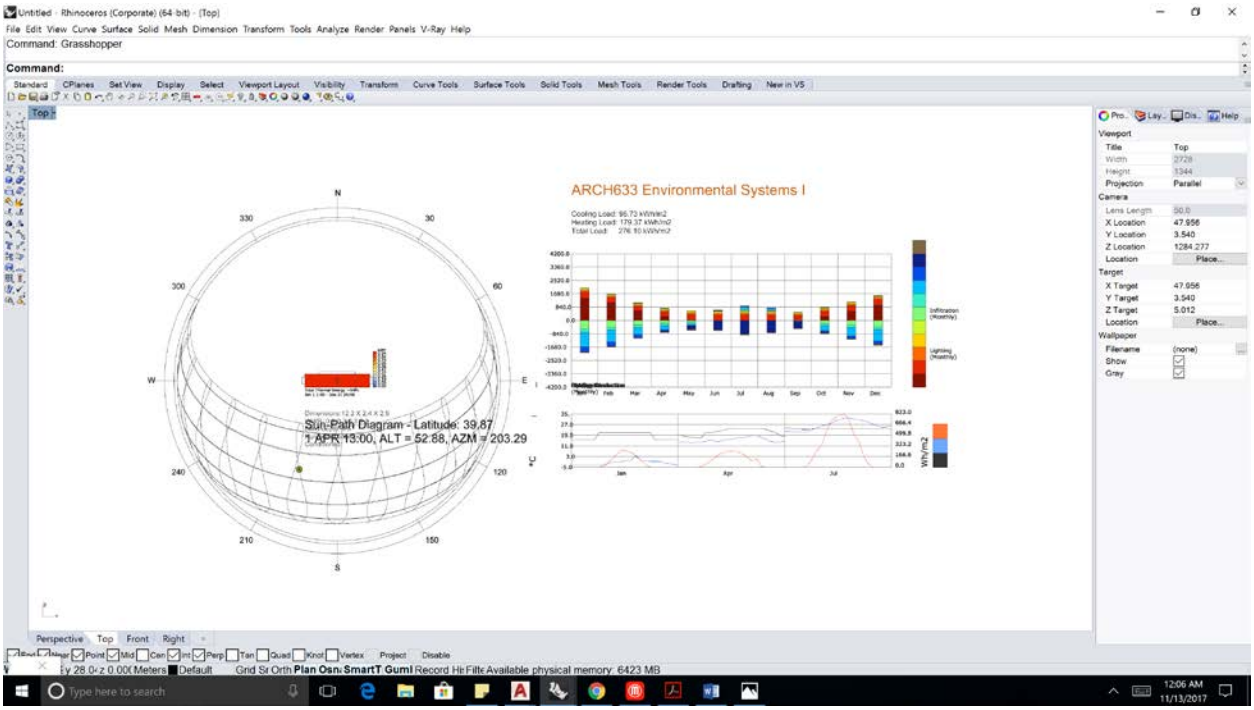

Wall to Window
Blinds
Construction
Thermal Mass
System
Results Visualization
Geometry
Grid of Containers
ARCH633

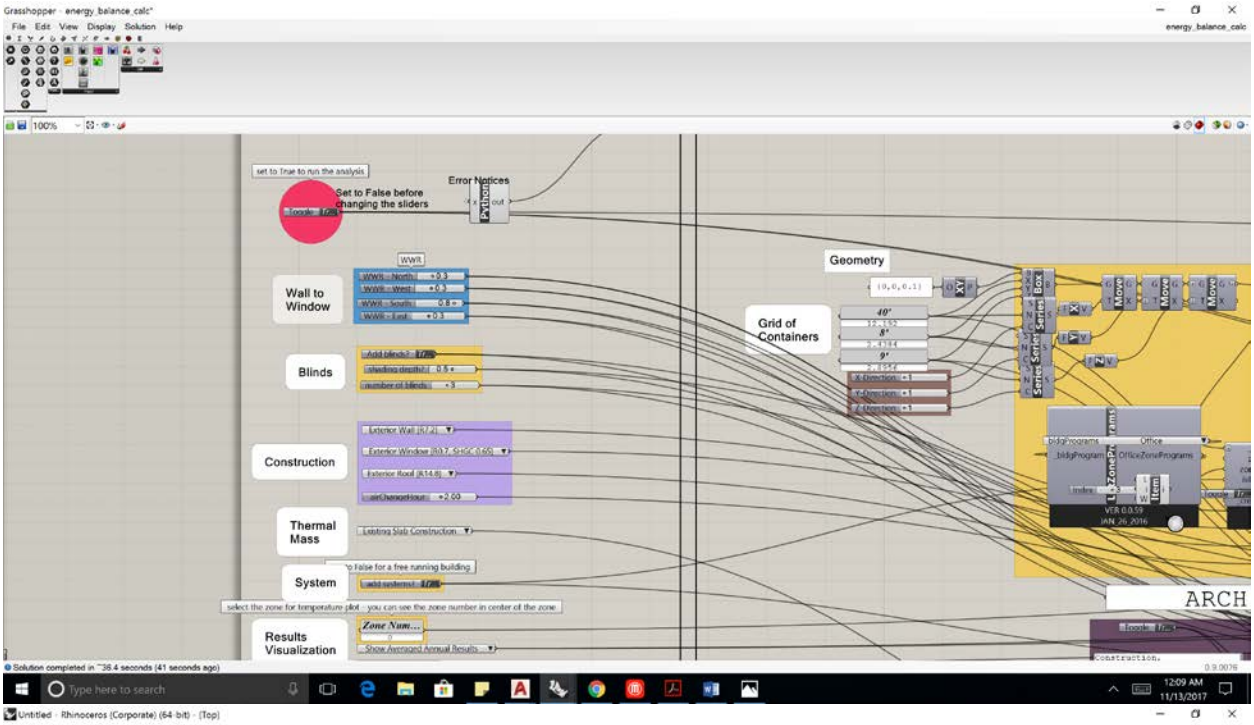

ARCH633 Environmental Systems I
Sun-Path Diagram - Latitude: 39.87
1 APR 13:00, ALT = 52.88, AZM = 203.29

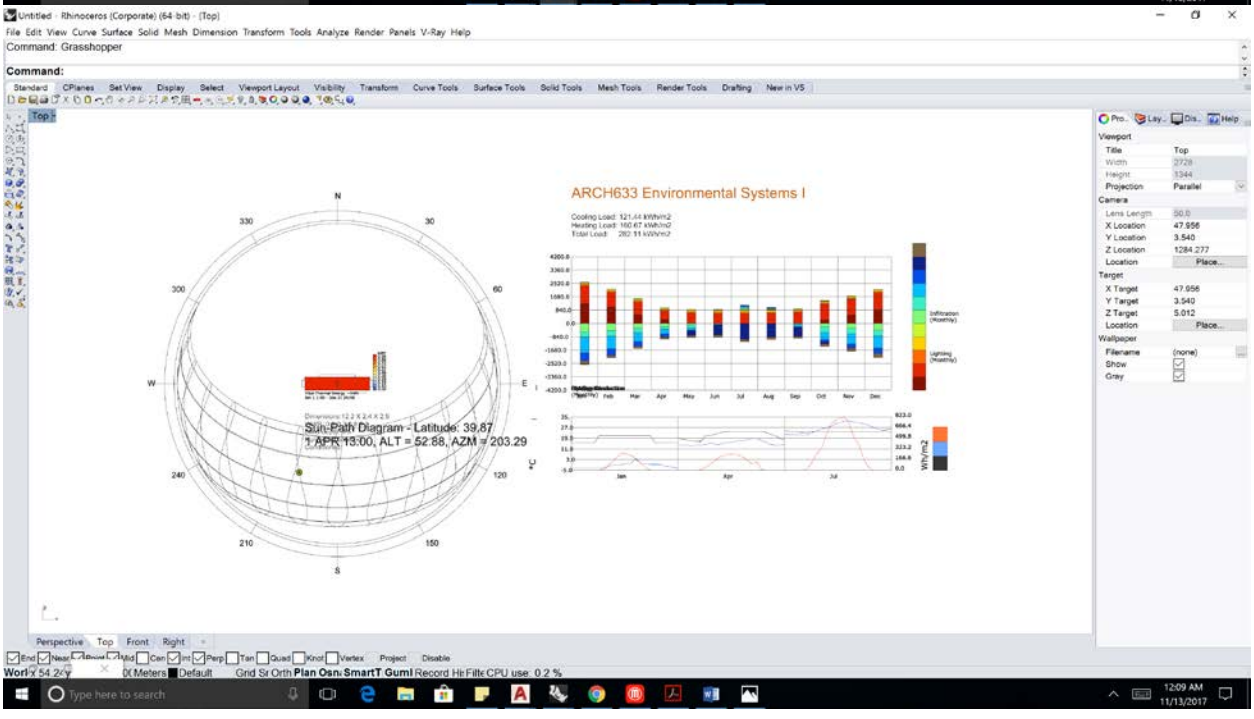

Grasshopper - energy_balance_calc*
File Edit View Display Solution Help
energy_balance_calc
set to True to run the analysis
Set to False before changing the sliders
Error Notices
Wall to Window
WWR
Blinds
Construction
Thermal Mass
System
Results Visualization
Geometry
Grid of Containers
Group
Group containing 4 objects.
ARCH
Solution completed in ~31.9 seconds (90 seconds ago)
Type here to search
11:57 PM
11/12/2017


Untitled - Rhinoceros (Corporate) (64-bit) - [Top]
File Edit View Curve Surface Solid Mesh Dimension Transform Tools Analyze Render Panels V-Ray Help
Command: Grasshopper
Command:
ARCH633 Environmental Systems I
Sun-Path Diagram - Latitude: 39.87
1 APR 13:00: ALT = 52.88, AZM = 203.29
Perspective Top Front Right
Type here to search
12:00 AM
11/13/2017


Grasshopper - energy_balance_calc*
File Edit View Display Solution Help
energy_balance_calc
set to True to run the analysis
Set to False before changing the sliders
Error Notices
Wall to Window
WWR
Blinds
Construction
Thermal Mass
System
Results Visualization
Group
Group containing 1 objects.
Geometry
Grid of Containers
ARCH
Type here to search
12:07 AM
11/13/2017


Untitled - Rhinoceros (Corporate) (64-bit) - [Top]
File Edit View Curve Surface Solid Mesh Dimension Transform Tools Analyze Render Panels V-Ray Help
Command: Grasshopper
Command:
Top
ARCH633 Environmental Systems I
Sun-Path Diagram - Latitude: 39.87
1 APR 13:00, ALT = 52.88, AZM = 203.29
Perspective Top Front Right
Type here to search
12:06 AM
11/13/2017


Grasshopper · energy_balance_calc*
File Edit View Display Solution Help
energy_balance_calc
set to True to run the analysis
Set to False before changing the sliders
Error Notices
Wall to Window
WWR - North
WWR - West
WWR - South
WWR - East
Blinds
Add blinds?
shading depth
number of blinds
Construction
Exterior Wall
Exterior Window
Exterior Roof
Thermal Mass
Existing Slab Construction
System
Results Visualization
Zone Num...
Show Averaged Annual Results
Geometry
Grid of Containers
X Direction
Y Direction
Z Direction
Office
OfficeZoneProgram
ARCH
Solution completed in ~36.4 seconds (41 seconds ago)
Type here to search
12:09 AM
11/13/2017


Untitled · Rhinoceros (Corporate) (64-bit) · (Top)
File Edit View Curve Surface Solid Mesh Dimension Transform Tools Analyze Render Panels V-Ray Help
Command: Grasshopper
Command:
Standard CPlanes Set View Display Select Viewport Layout Visibility Transform Curve Tools Surface Tools Solid Tools Mesh Tools Render Tools Drafting New in V5
Top
ARCH633 Environmental Systems I
Cooling Load: 121.44 kWh/m2
Heating Load: 160.67 kWh/m2
Total Load: 282.11 kWh/m2
Sun-Path Diagram - Latitude: 39.87
1 APR 13:00, ALT = 52.88, AZM = 203.29
Viewport
Title Top
Width 2728
Height 1344
Projection Parallel
Camera
Lens Length 50.0
X Location 47.956
Y Location 3.540
Z Location 1284.277
Location Place...
Target
X Target 47.956
Y Target 3.540
Z Target 5.012
Location Place...
Wallpaper
Filename (none)
Show
Gray
Perspective Top Front Right
Type here to search
12:09 AM
11/13/2017

Which parameter(s) is/are the most effective?

The total energy load was lowest through a combination of changing the blinds and the R-value for the roof and the walls. By adding blinds, both the heating and cooling loads decreased, but the change in the cooling load was more drastic going from 150 kWh/m2 to around 99 kWh/m2 indicating that blinds do reduce the amount of sun/heat going into the shipping container. This combined with the increase of the R-values of the roof and walls reduced the heating load since there would be less heat loss with higher R-values.

What is the temperature range inside the container in summer and winter with no systems after applying all your changes?

The temperature ranges from -1 to 5 *C in the winter and then from 27 to 35+ *C in the summertime. When the system is turned off, the temperature is no longer regulated like before where the interior temperature was more consistent. Therefore, the temperature is mostly dependent on outdoor weather temperatures which causes the large fluctuations in temperature.