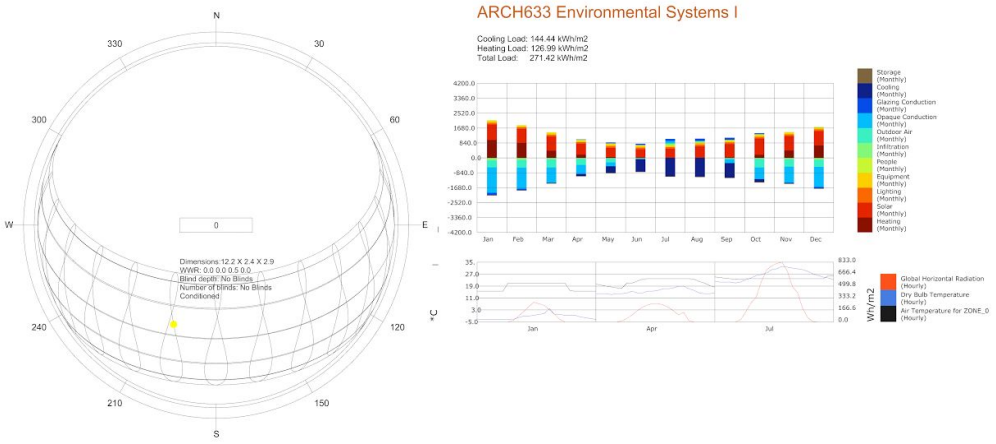
Mariela Hernandez
ARCH-633_Assignment 10

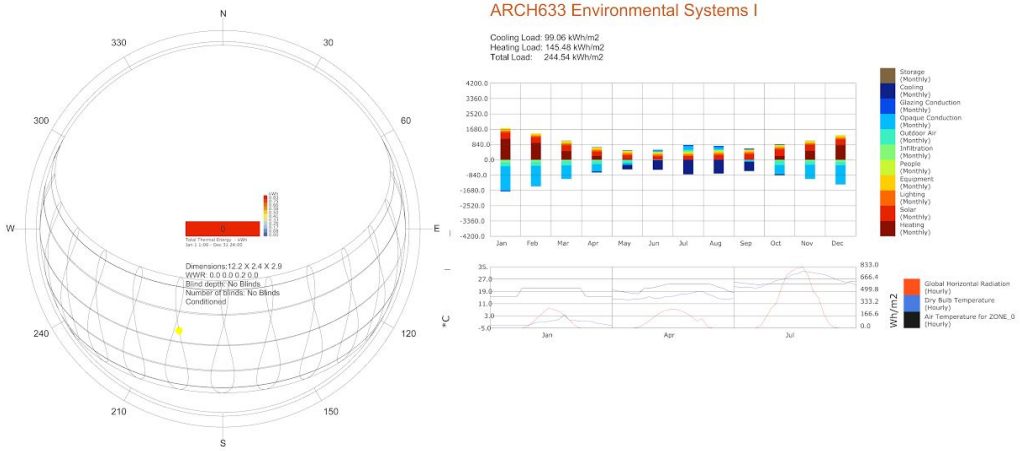
1. **Window to wall ratio**
   a. South 0.5 : Total load 271.42 kWh/m2



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

   i.
   ii. The cooling load is higher than the heating load so, I'll try reducing the size of the window to southern exposure.

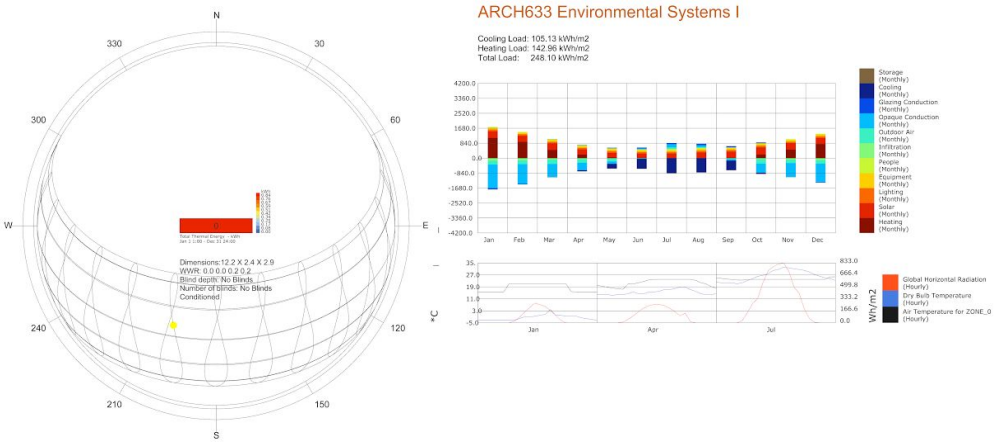
   b. South 0.2 : Total load 244.54 kWh/m2



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

   i.
   ii. The cooling load was reduced. Now I can allow eastern exposure to sun to naturally heat the space during winter and reduce heating loads.

   c. East 0.2 : Total load 248.10 kWh/m2

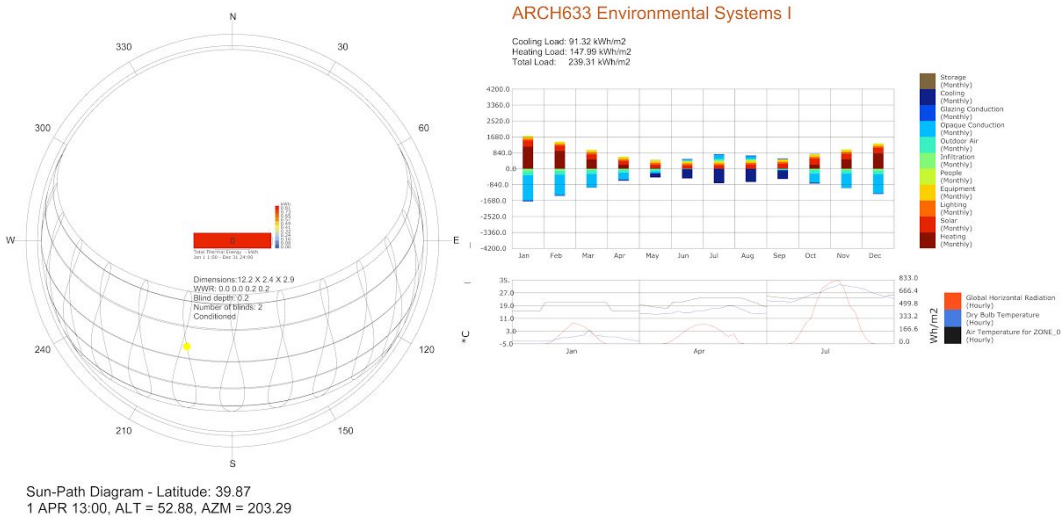


i.

ii. Though the heating loads were reduced, the total load has increased.

2. Blinds

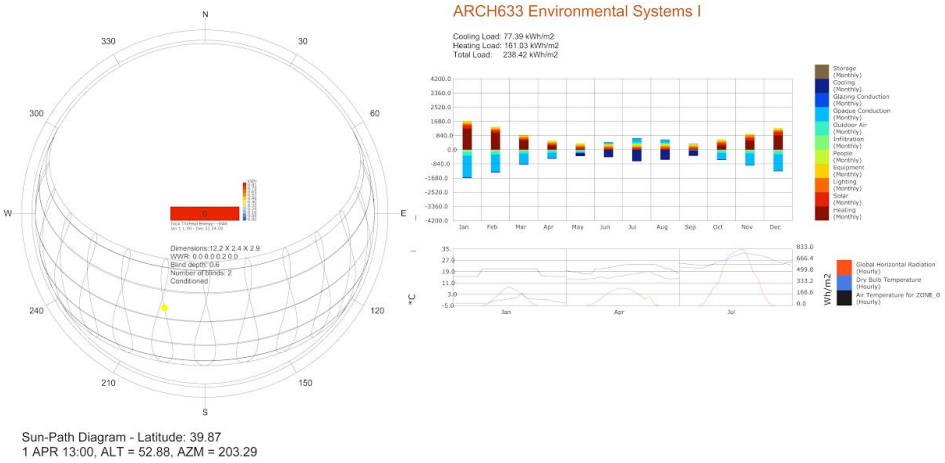
a. 2 blinds at 0.2 depth : Total load 239.31 kWh/m2



i.

ii. This has greatly reduced the cooling load and total, but the heating load has increased with added shading. I will increase the depth of the shading device in order to reduce the cooling load more and I will go back a step and remove the window which is exposed to the East in order to balance the heating load.

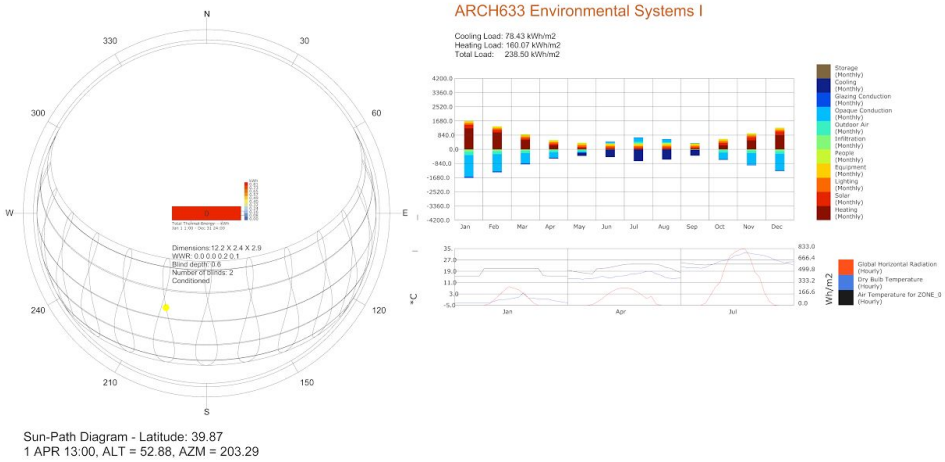
b. 2 blinds at 0.6 depth : Total load 238.42 kWh/m2



i.

ii. As predicted, the cooling load was reduced with a deeper shading device, but the removal of the eastern exposed window did not help for the winter heating loads.

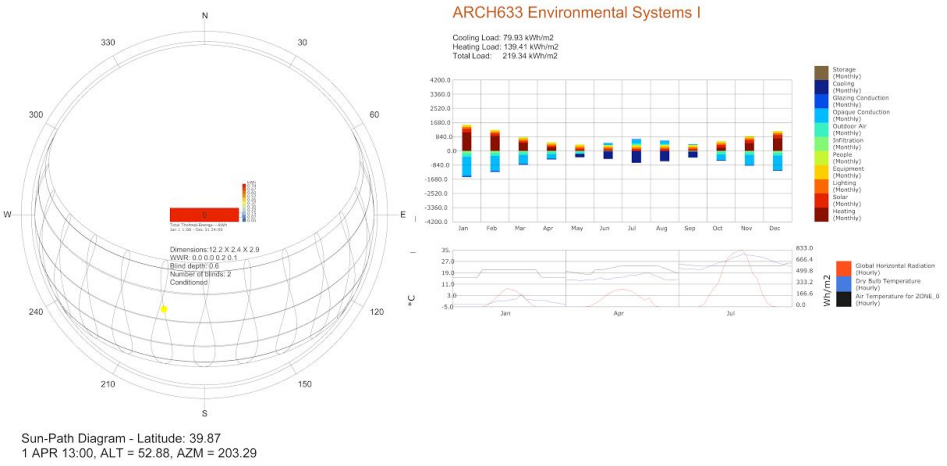
c. 2 blinds at 0.6 depth (added 0.1 window exposure to East) : Total load 238.50 kWh/m2



i.

ii. Although the heating load reduced a bit, the total load has not changed very much so, I will move onto testing the Construction type.

3. **Construction** (the above tests were conducted with Exterior Wall R5.5, Exterior Window R0.7 and Exterior Roof R9.2)
   a. Exterior Wall increased to R7.2 : Total load 219.34 kWh/m2



i.

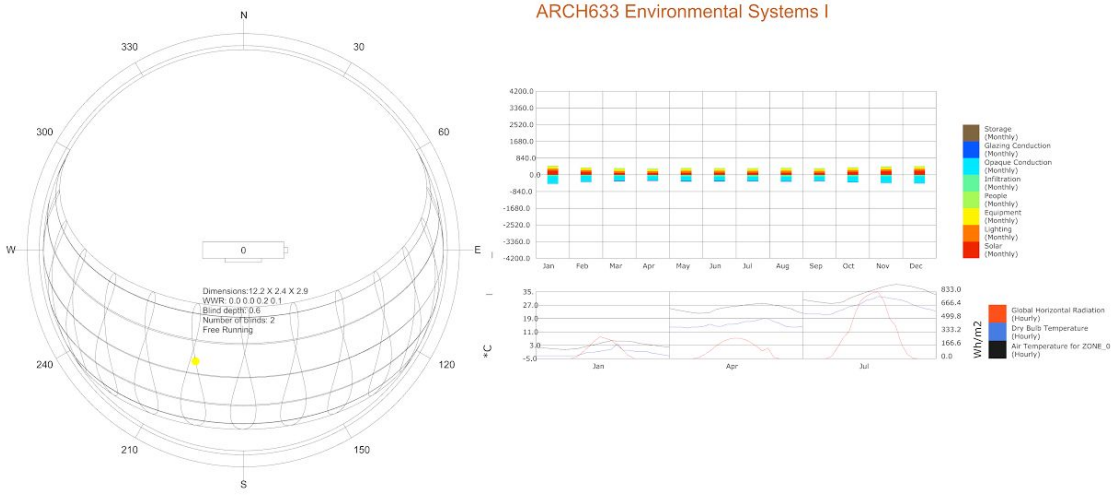
b. Exterior Window increased to R1.7 SHGC 0.39 : Total load 237.10 kWh/m2
    i. R1.0 SHGC 0.7 : Total load 246.52 kWh/m2
    ii. I will keep the original R0.7, SHGC 0.65 : Total load 219.34 kWh/m2
c. Exterior Roof increased to R14.8 : Total load 203.52 kWh/m2
    i. increased to R34.4 : Total load 190.05 kWh/m2
d. Exterior Wall increased to R10.4 : <u>Total load 165.86 kWh/m2</u>
e. It seems that the most effective method of insulation for the opaque constructions was in the wall construction while the window assembly was a much more difficult factor to control. A higher R-value did not produce a better load calculation and the higher the SHGC value resulted in the less efficient construction.

4. Thermal mass

a. +4 inches of concrete : Total load 165.86 kWh/m2
    i. No change in total load
b. +8 inches of concrete : Total load 165.86 kWh/m2
    i. No change in total load

- Which parameter(s) is/are the most effective?
    - Most - The insulation of opaque material (Construction) offered the most significant effects followed by the window to wall ratio and orientation of the opening.
    - Least - The increase of thermal mass was the least effective and the increase of R-value for the glazing part of the construction was counterproductive to the total load.
- What is the temperature range inside the container in summer and winter with no systems after applying all your changes?
    - Winter temperatures from -5 to 4 degrees Celsius (moderate cold stress)
    - Summer temperatures from 22 to 32 degrees Celsius (moderate heat stress)

Mariela Hernandez
ARCH-633_Assignment 10



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

○