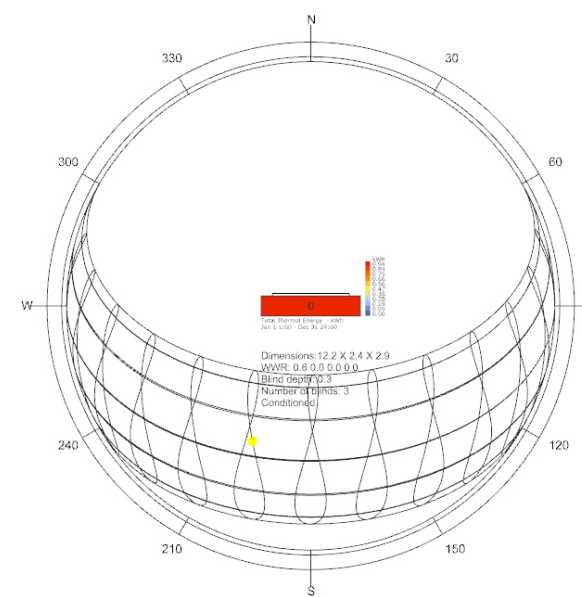


# Environmental Systems

Project 10

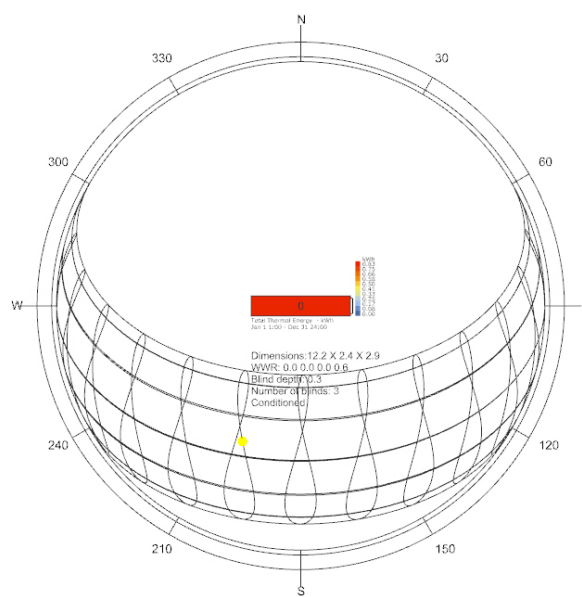
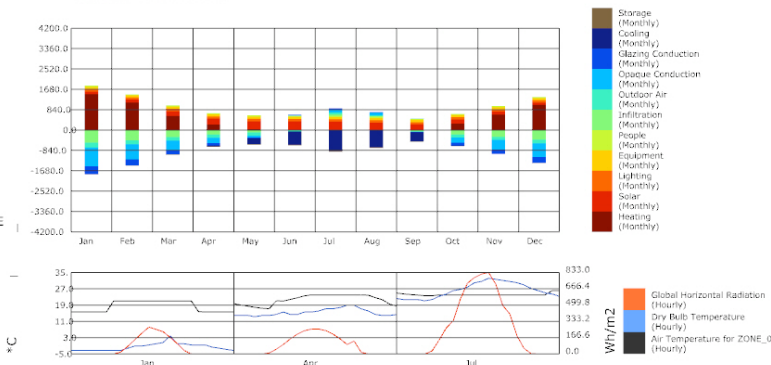
Fall 2017  
ARCH 633



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

### ARCH633 Environmental Systems I

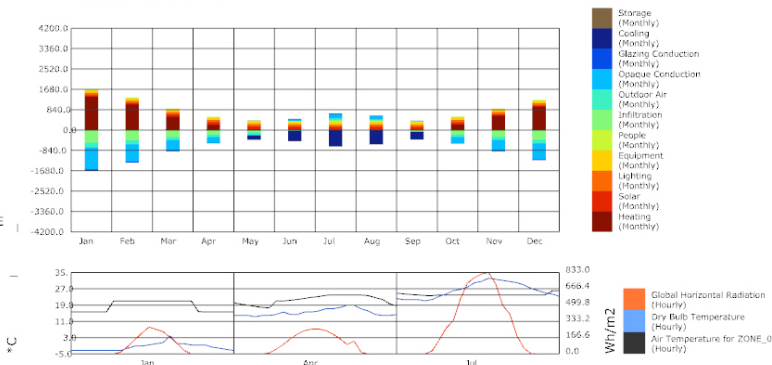
Cooling Load: 94.68 kWh/m2  
Heating Load: 181.82 kWh/m2  
Total Load: 276.49 kWh/m2



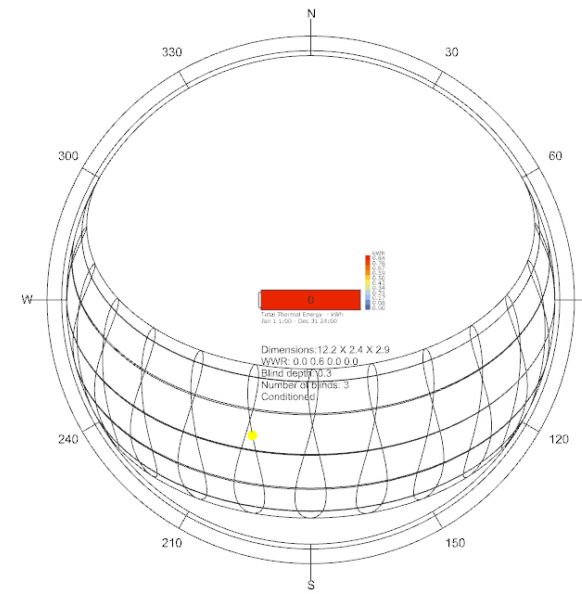
Sun-Path Diagram - Latitude: 39.87  
1 APR 13:00, ALT = 52.88, AZM = 203.29

### ARCH633 Environmental Systems I

Cooling Load: 74.87 kWh/m2  
Heating Load: 169.36 kWh/m2  
Total Load: 244.23 kWh/m2



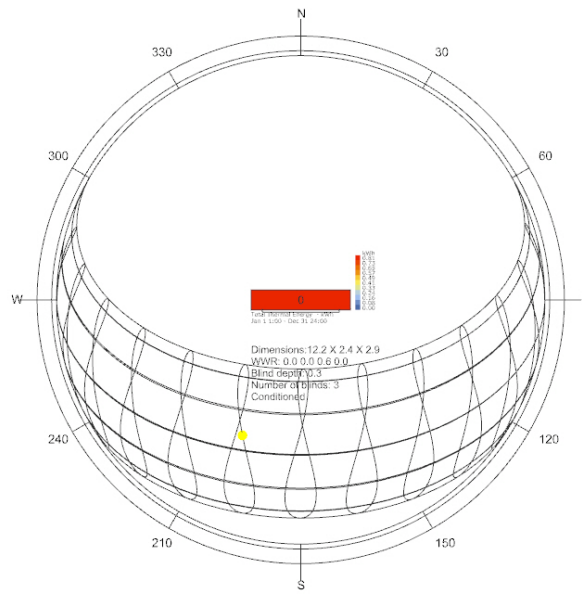
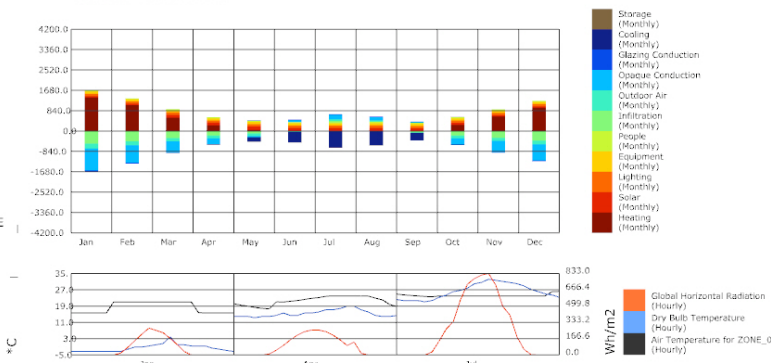
## North Window



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

### ARCH633 Environmental Systems I

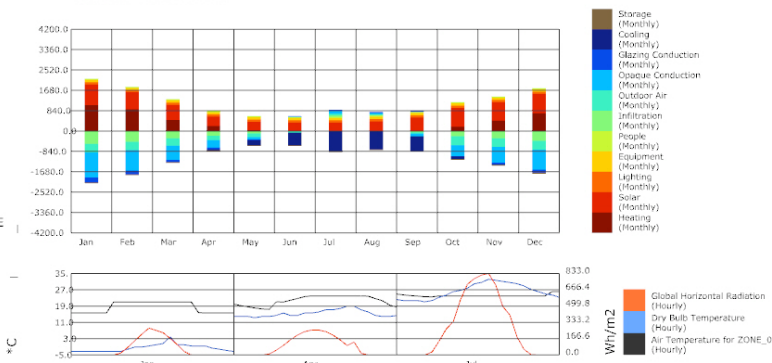
Cooling Load: 75.68 kWh/m2  
Heating Load: 172.03 kWh/m2  
Total Load: 247.71 kWh/m2



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

### ARCH633 Environmental Systems I

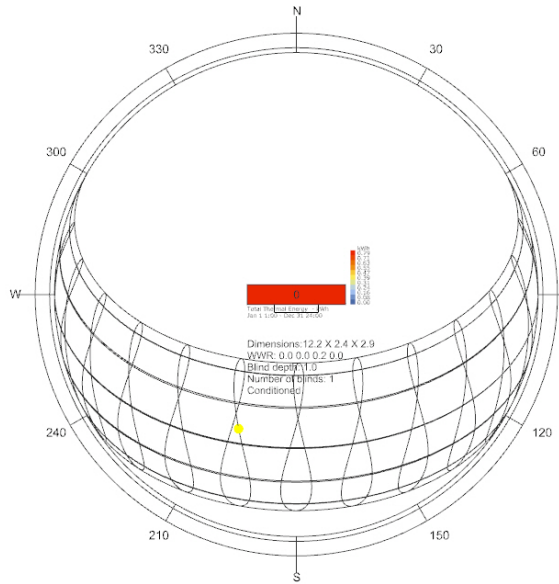
Cooling Load: 104.84 kWh/m2  
Heating Load: 135.04 kWh/m2  
Total Load: 239.88 kWh/m2



## West Window

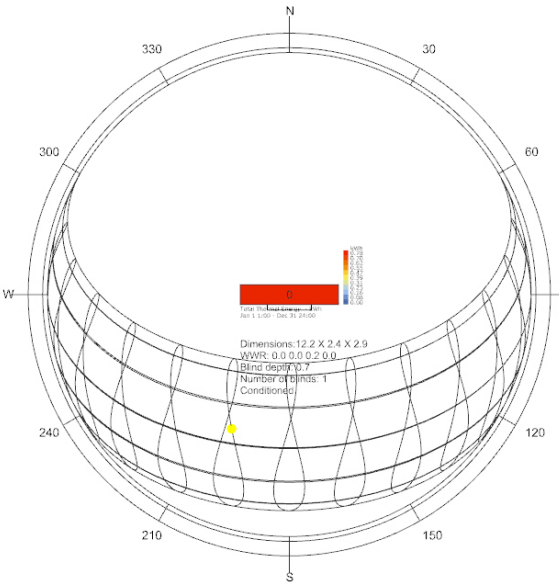
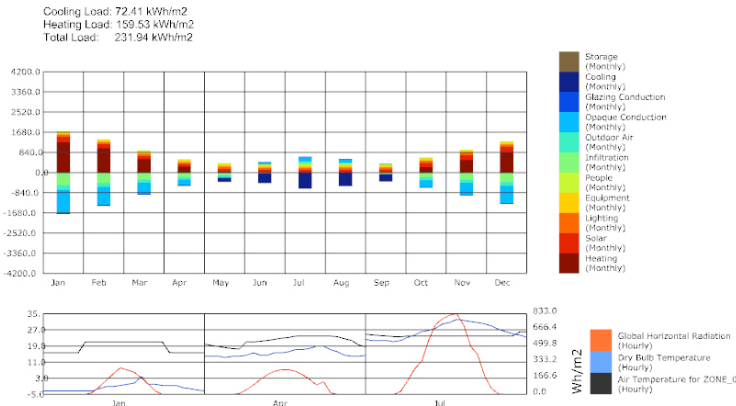
Experimenting with the location of the different openings and the orientation of them, while keeping everything else the same. Although the introduction of the windows affects the load due to the glass conduction of the surface area, but having it on the south side allows for radiation that could be used during the winter to heat up the building.

## South Window



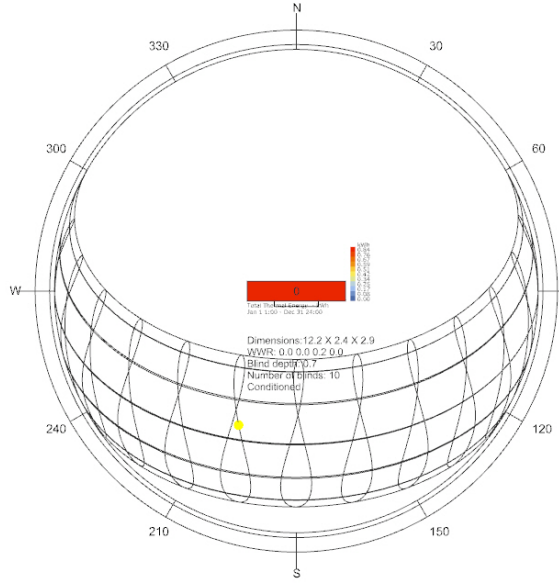
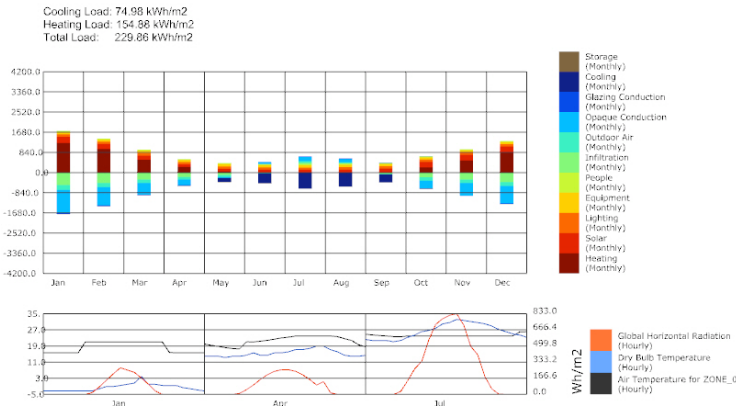
Sun-Path Diagram - Latitude: 39.87  
1 APR 13:00, ALT = 52.88, AZM = 203.29

ARCH633 Environmental Systems I



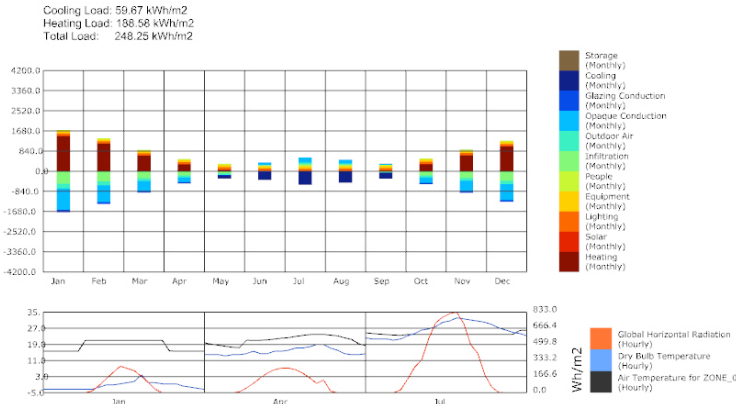
Sun-Path Diagram - Latitude: 39.87  
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ARCH633 Environmental Systems I



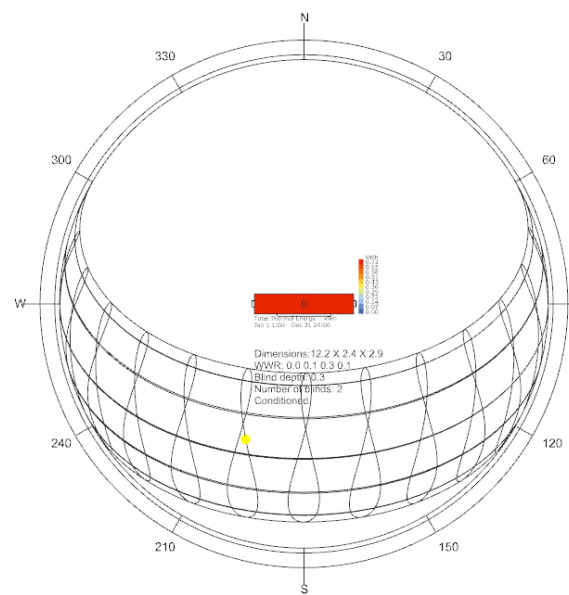
Sun-Path Diagram - Latitude: 39.87  
1 APR 13:00, ALT = 52.88, AZM = 203.29

ARCH633 Environmental Systems I



10 Blinds Depth 1.0

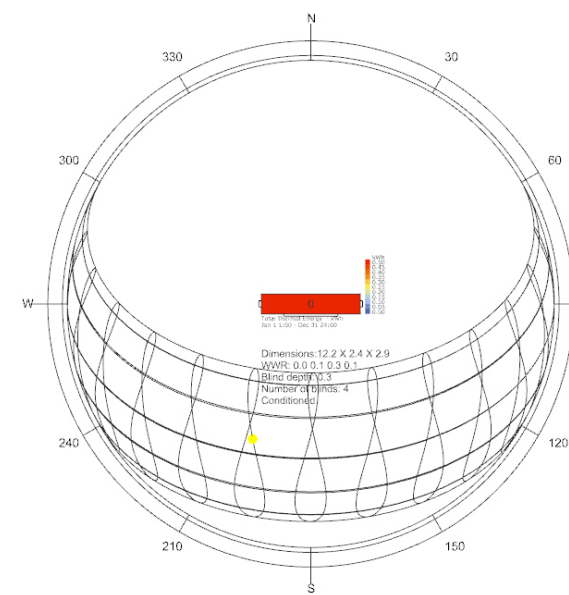
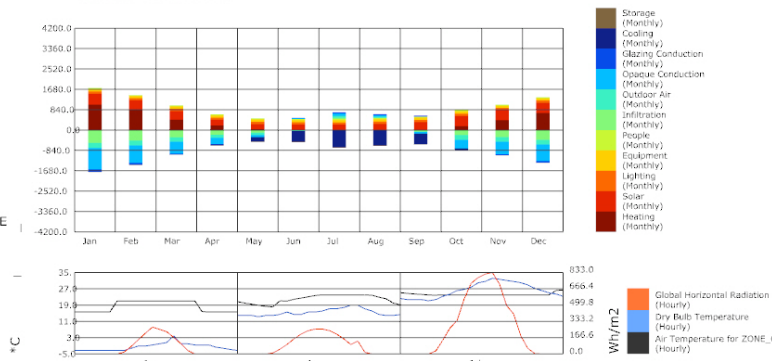
Now it was the time to change the blinds that were used on the windows. Keeping the number of blinds to 1 and changing the depth showed that a full span will not allow for radiation during the winter but short span does allow for the summer radiation to enter the building as well, so keeping it half way was ideal. Then changing the numbers of blinds to realize then that the sun will not be able to enter



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

## ARCH633 Environmental Systems I

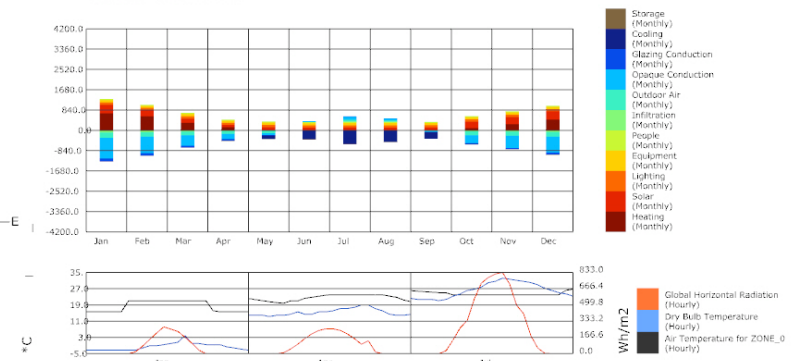
Cooling Load: 84.40 kWh/m<sup>2</sup>  
Heating Load: 128.36 kWh/m<sup>2</sup>  
Total Load: 212.76 kWh/m<sup>2</sup>



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

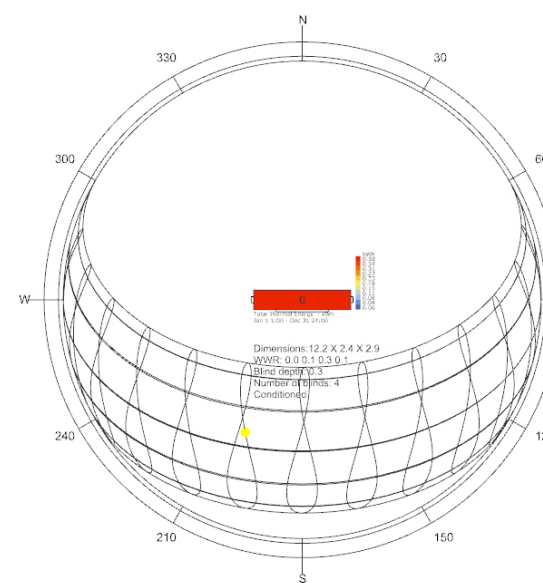
## ARCH633 Environmental Systems I

Cooling Load: 62.95 kWh/m<sup>2</sup>  
Heating Load: 85.58 kWh/m<sup>2</sup>  
Total Load: 148.53 kWh/m<sup>2</sup>



Windows on West, East and South Side

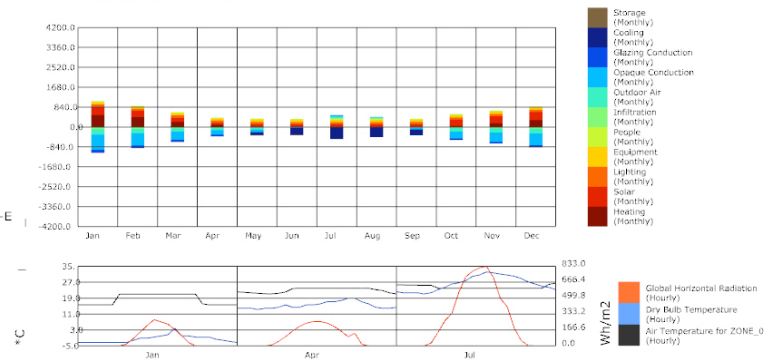
Airchange per hour at 0.35



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

## ARCH633 Environmental Systems I

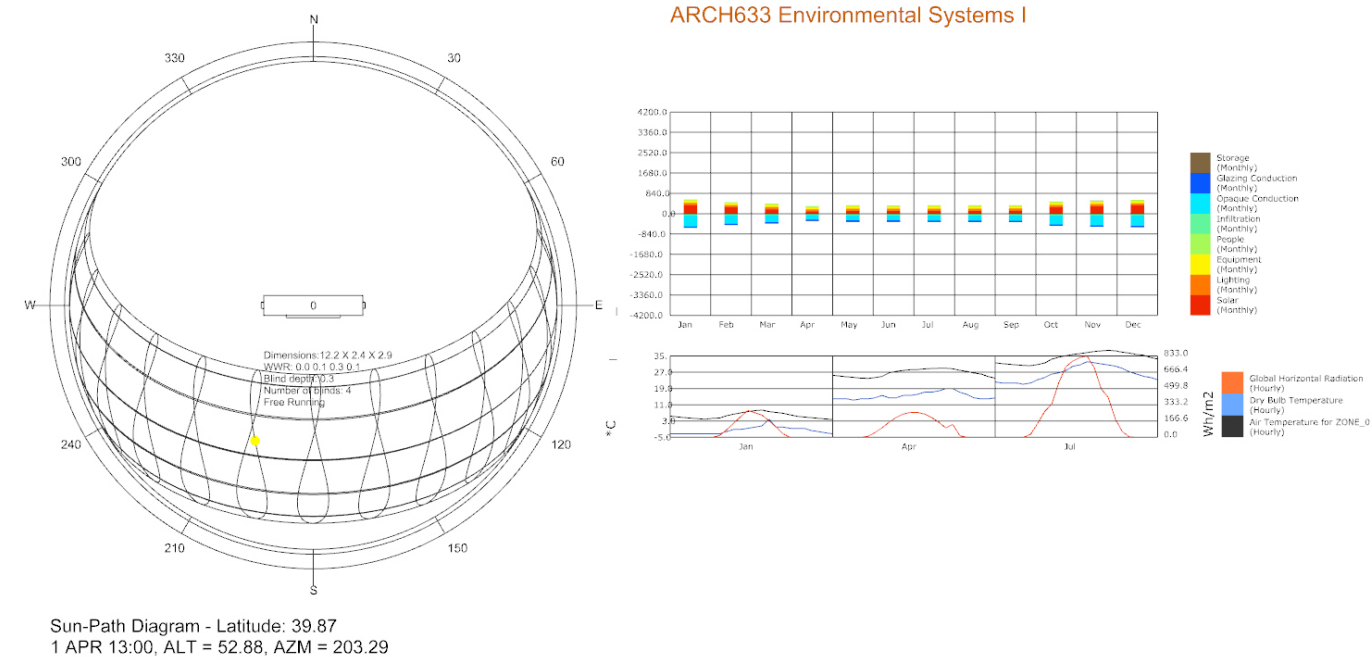
Cooling Load: 54.21 kWh/m<sup>2</sup>  
Heating Load: 58.28 kWh/m<sup>2</sup>  
Total Load: 112.49 kWh/m<sup>2</sup>



Resistance on the Wall and Roof was increased

Adding smaller windows on the West and the East was essential for the interchange through cross ventilation. The infiltration of the building was changed from 2.00 per hour to 1.0 and then to 0.35. The infiltration did create a big change due to the heated and cooled air that was not allowed to leave the building very quickly. Then the resistance of the building to improve the wall and the roof materials which then reduced the total load drastically.

ARCH633 Environmental Systems I



With no systems

Final Conclusion

Thermal Mass did not have a relative change through the loads of the building. But in fact the wall to window ratio and the use of good materials and the radiation is what was essential to improve and lower the total loads on the building.

From the result found with no systems activated, it was noticeable to find that the building is warmer from the outdoor temperature and ranged between 5 degrees to 9 degrees Celsius. While in April the building had a range between 24 and 28 Celsius which is a relatively good temperature. In the Summer the building is still a little high with a range from 29 to 36 degrees Celsius.