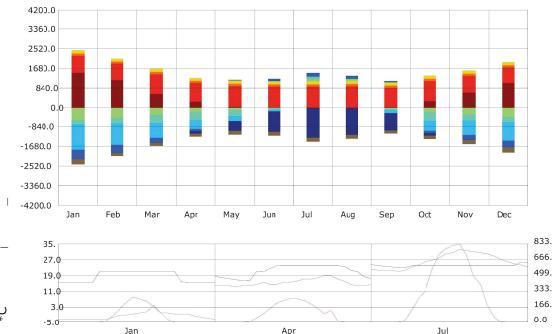


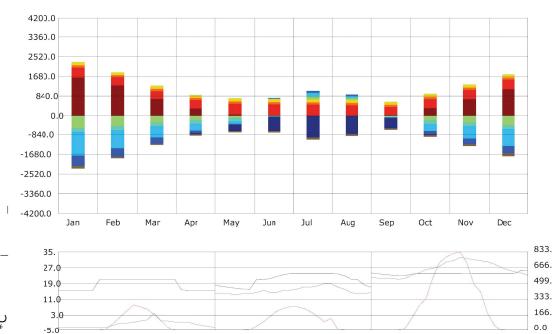
ARCH633 Environmental Systems I

Cooling Load: 164.02 kWh/m²
Heating Load: 187.72 kWh/m²
Total Load: 351.74 kWh/m²



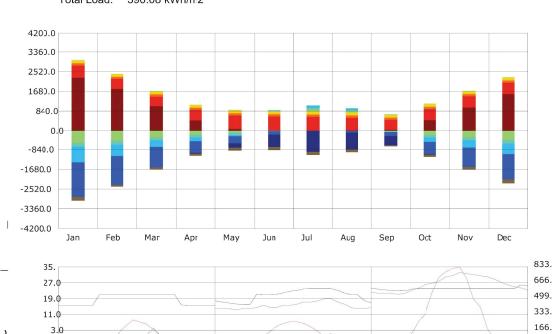
ARCH633 Environmental Systems I

Cooling Load: 108.26 kWh/m²
Heating Load: 209.14 kWh/m²
Total Load: 317.39 kWh/m²



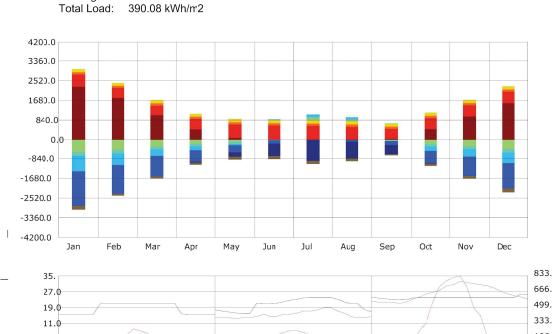
ARCH633 Environmental Systems I

Cooling Load: 98.48 kWh/m²
Heating Load: 291.60 kWh/m²
Total Load: 390.08 kWh/m²



ARCH633 Environmental Systems I

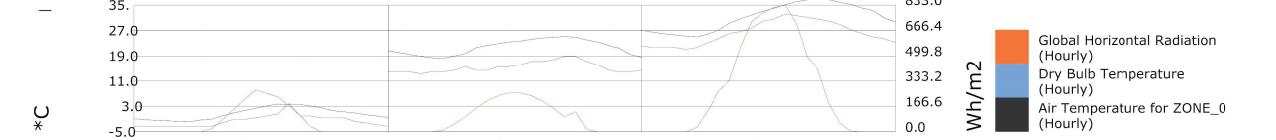
Cooling Load: 98.48 kWh/m²
Heating Load: 291.60 kWh/m²
Total Load: 390.08 kWh/m²



Conclusion:

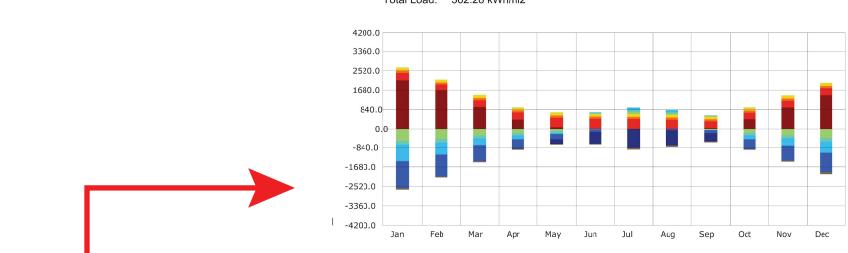
-through applying different changes to the system the parameters that brings the largest impact are window opening and material properties.

-the temperature range for winter ranges from -1 to 4 degree Celsius. the temperature range for summer ranges from 27 to 37 degree Celcius



ARCH633 Environmental Systems I

Cooling Load: 90.61 kWh/m²
Heating Load: 271.67 kWh/m²
Total Load: 362.28 kWh/m²



Step1: adjusted the window setting from default. North: 0.6. South: 0.5. East & West: 0.2. Initially thought allowing more light in South and North direction would help reduce the heating load but the total load gone up

Step 2: tried to add blinds to reduce the cooling load. Shading helped reduced the cooling load from ~164 to ~108. Even though there is a slight rise in heating load but overall the total gone down from ~351 to ~317.

Step 3: Change the material setting to increase the R value to help reduce the heating load. The opaque conduction has decreased dramatically after exterior wall and roof value is changed to R 10.4 and R 14.8. However, the totally heating load has gone up. Could be due to the change in window from R 0.7 SHGC 0.65 to R 1 SHGC 0.7 because the glazing conduction has increased.

Step 4: tested the effect of adding thermal mass, no change was recorded

Step 5: readjusted to window setting to North: 0.5. South: 0.4. East & West: 0.1. The total load decrease from ~390 to ~362.

Step 6: Following the logic that changing the windows smaller will help improve reduced total load, the window dimensions are readjusted again to North: 0.4. South: 0.3. East and West: 0. The total load is reduced to ~339

Step 7: reduced blind depth from 0.5 to 0.3 to help reduce the cooling load and it worked. However the end result is not significant as the total load only changed around 4 kWh/m²

Step 8: Readjusted the major setting. Increased the R value of wall and roof to 14.8 and 34.4. Since glazing is still an issue, this time I picked the glass with highest R value with R 1.9 and SHGC 0.39. With this change the total work load is now below 300 at around 263 kWh/m²

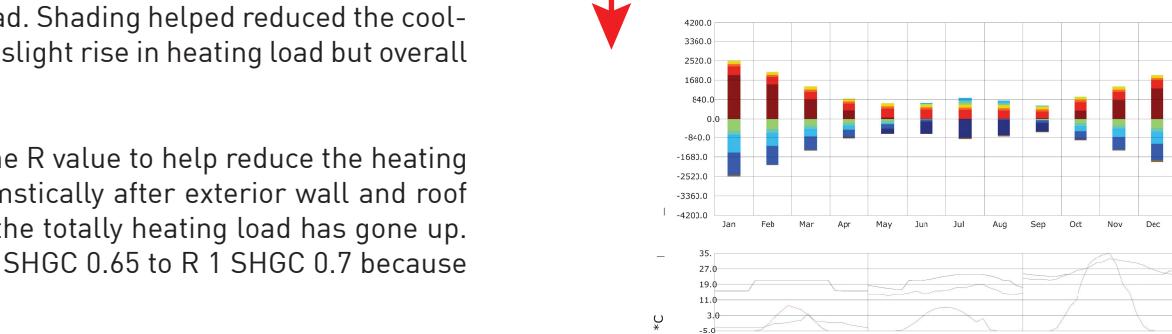
ARCH633 Environmental Systems I

Cooling Load: 85.36 kWh/m²
Heating Load: 253.62 kWh/m²
Total Load: 338.98 kWh/m²



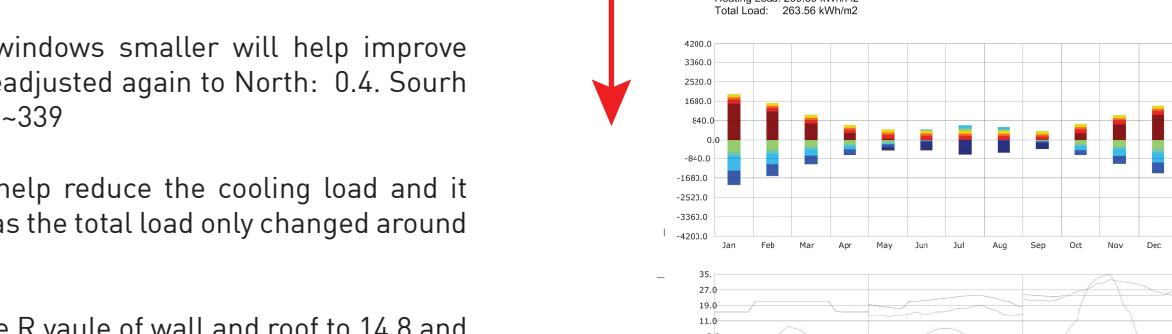
ARCH633 Environmental Systems I

Cooling Load: 91.18 kWh/m²
Heating Load: 243.59 kWh/m²
Total Load: 334.77 kWh/m²



ARCH633 Environmental Systems I

Cooling Load: 63.18 kWh/m²
Heating Load: 200.39 kWh/m²
Total Load: 263.56 kWh/m²



ARCH 633 Assignment 9

Zheng Yang Zhu