ARCH 633 ENVIRONMENT SYSTERM

Assignment 10, Building energy balance II

Ting Su

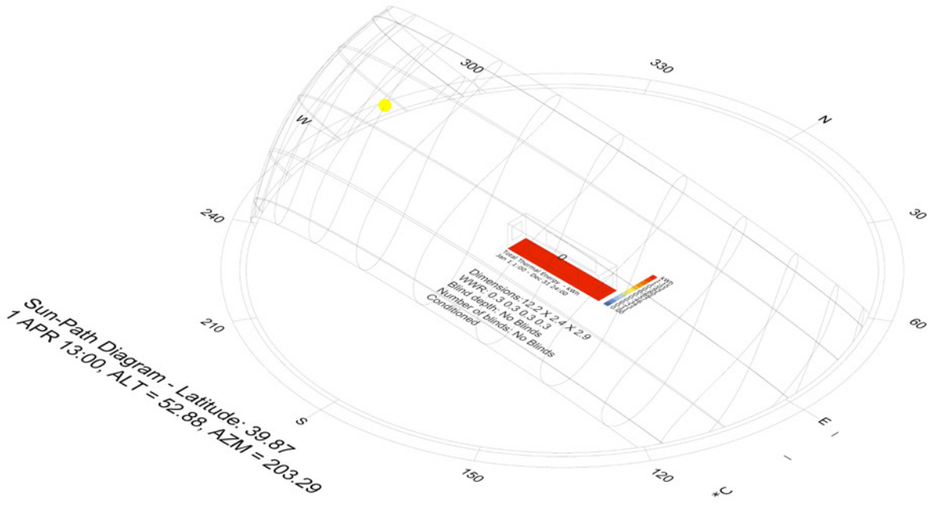
DESIGN STRATAGE

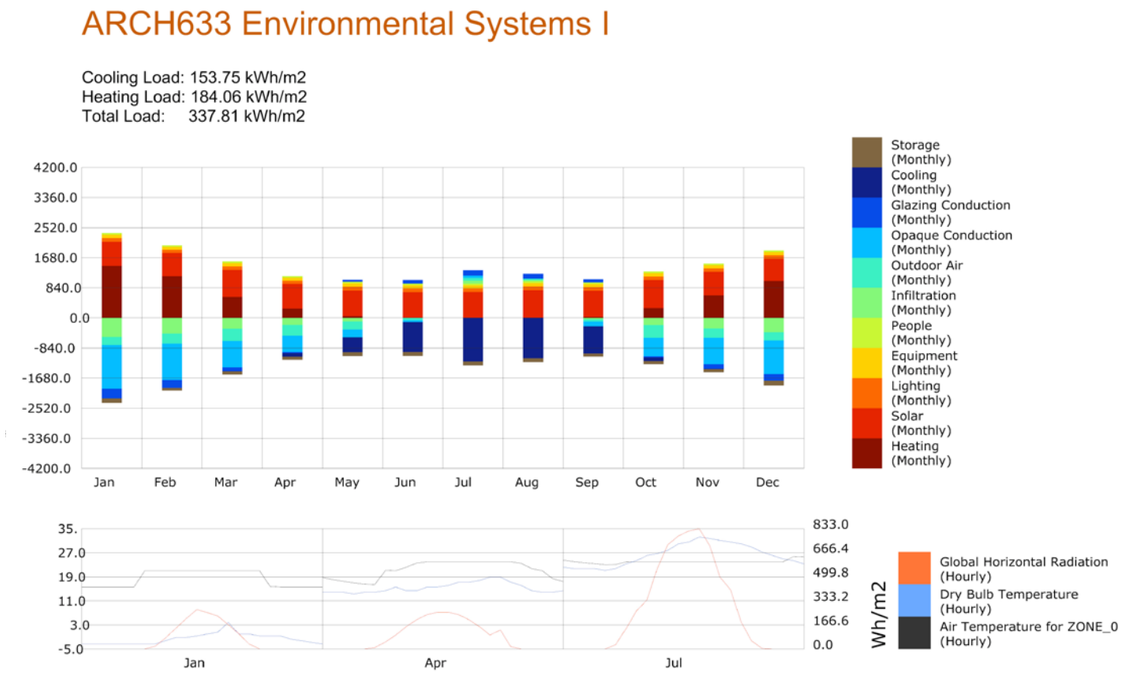
There are four mainly factors that can influence the result of building energy balance, they are listed below. The design stratage will follow and analysis these four main factor to find the best solution how to make a more effective passive house.

1. Orientation
2. Blind
3. Themal mass
4. Structrue elements

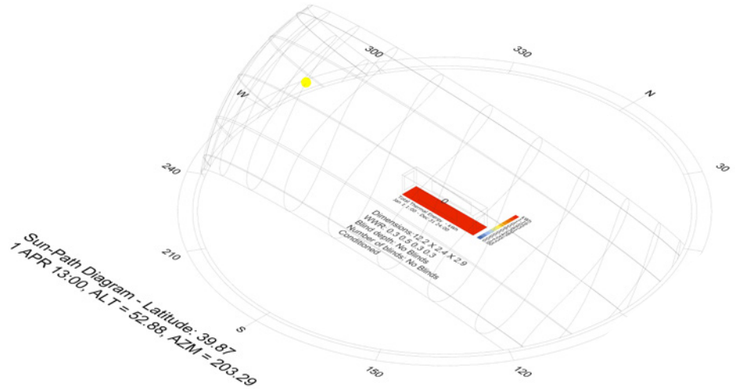
“Default setting”

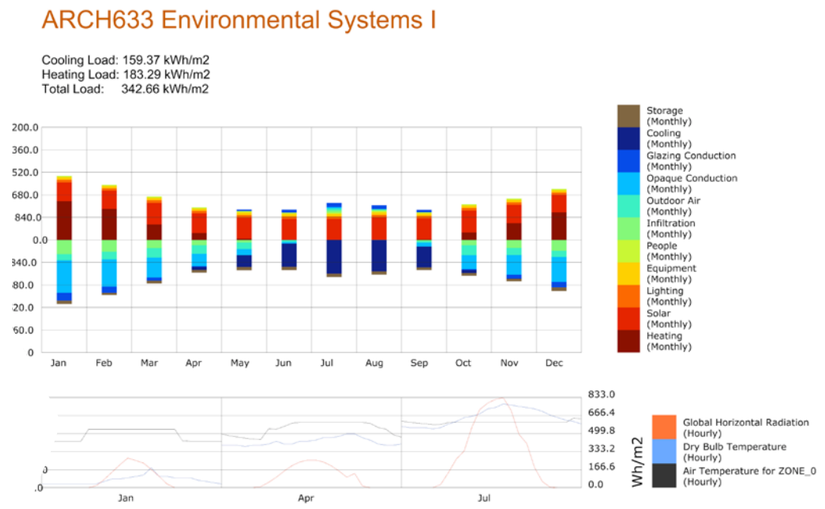
Orientation: NSEW Window ration 0.3
Blind: 0
Thermal Mass: none
Structure: exterior wall: R5.5; exterior windiw: R0.7; exterior roof: R9.2; air change hour: 2h





1. Orientation

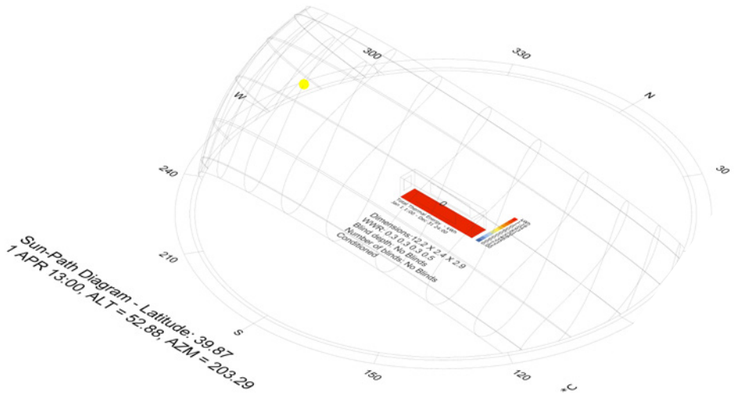


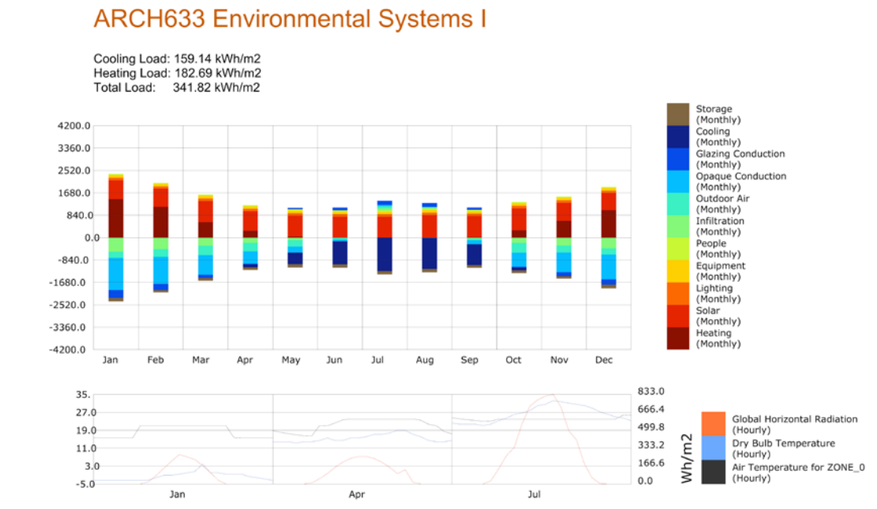


Compared with “default” setting, under the same circumstance, when the window ration increase in **West and East direction**, the **Cooling Load increase**, but the **Heating Load decrease.**

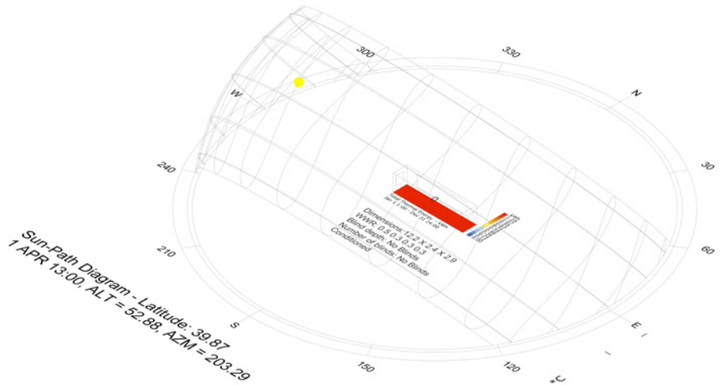
West 0.5

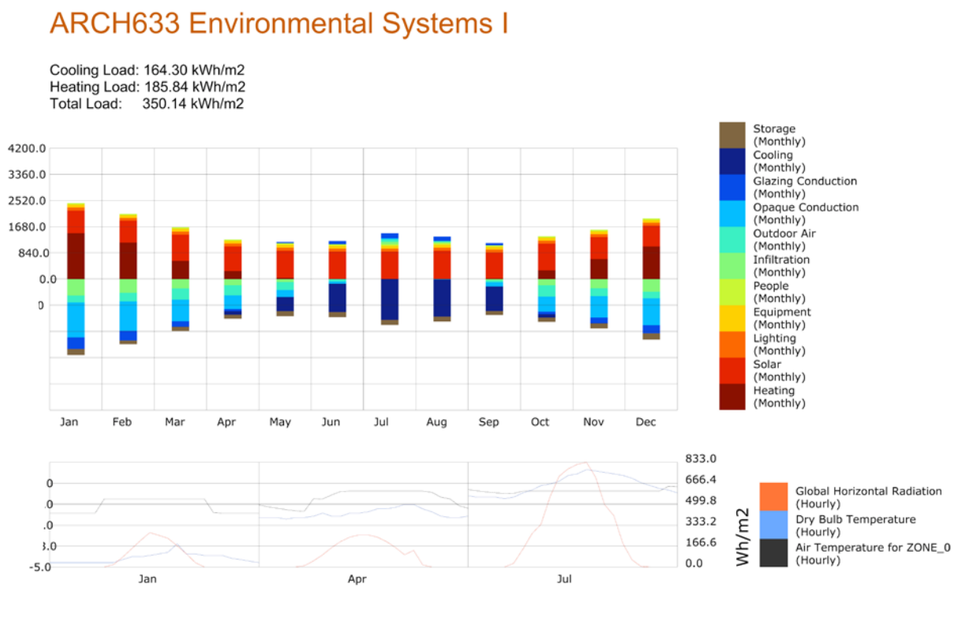
East 0.5





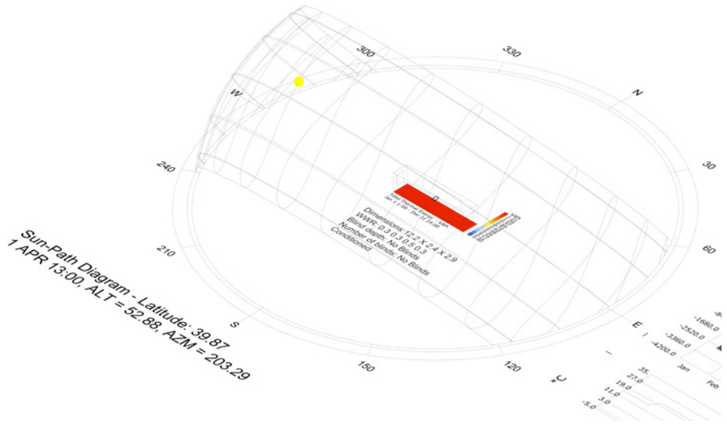
Noth 0.5





Compared with “default” setting, under the same circumstance, when the window ration increase in **North direction**, the **Cooling Load and Heating Load increase.**

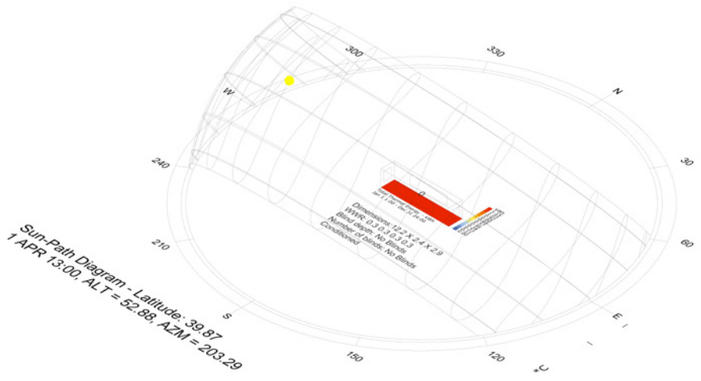
South 0.5

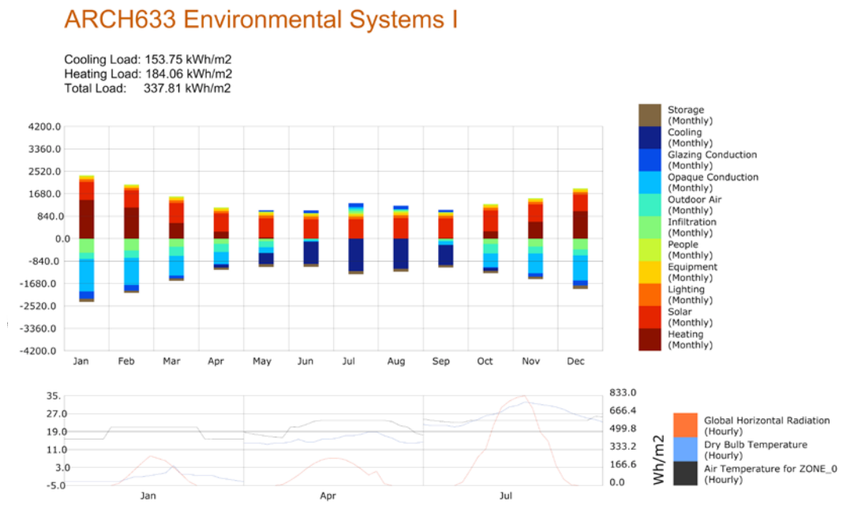


Compared with “default” setting, under the same circumstance, when the window ration increase in **South direction**, the **Cooling Load increase**, but the **Heating Load decrease.**

2. BLINDS

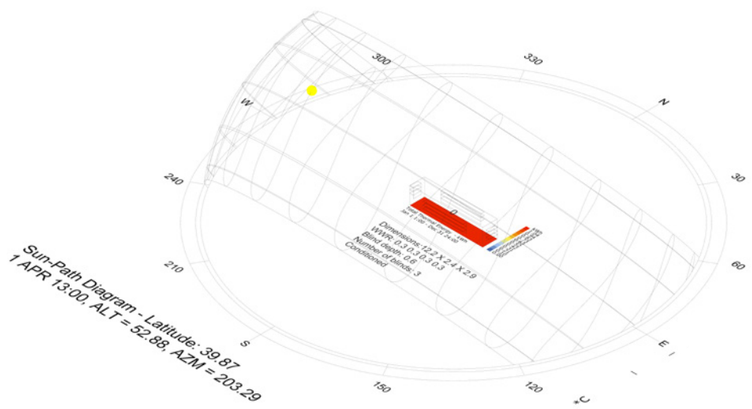
-Blinds numbers

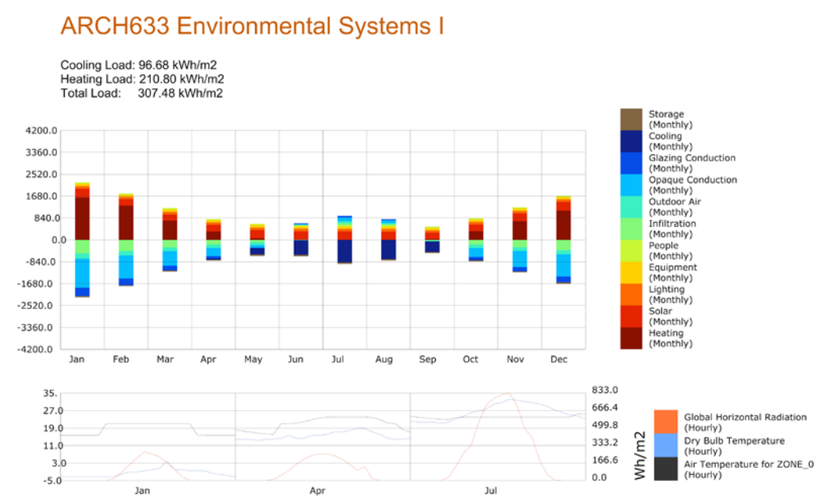




Compared with “default” setting, under the same circumstance, the **more layer** of blinds windows have, **the lower total loads** building will have.

Blinds depth 0

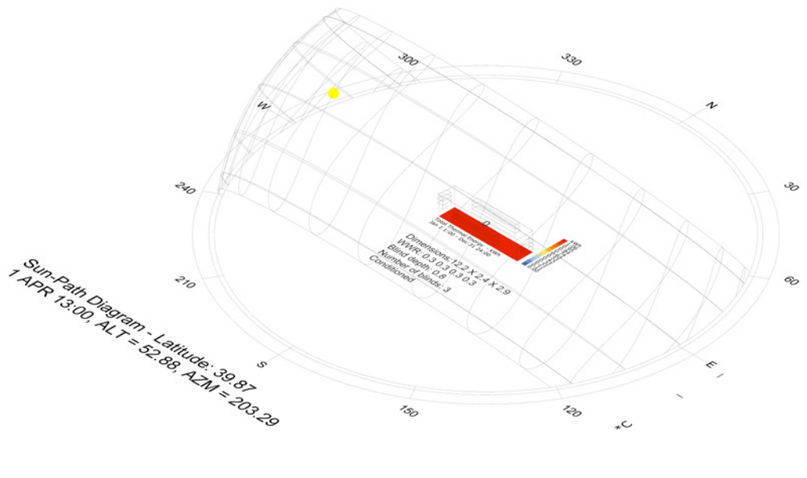


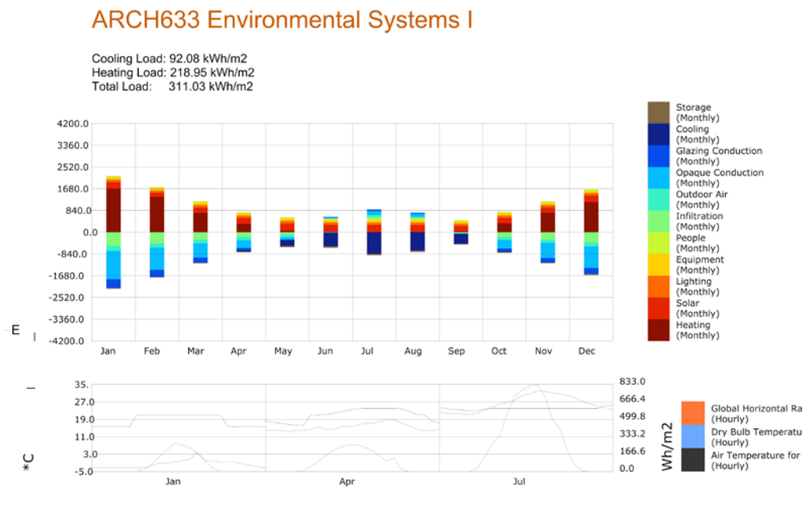


Blinds depth 3

2. BLINDS

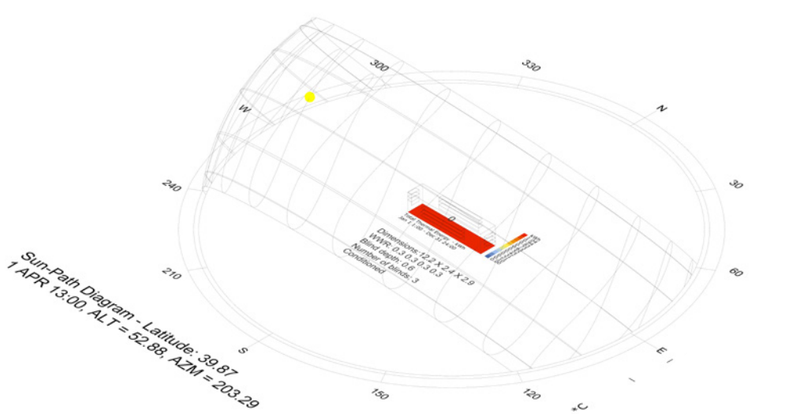
-Blinds depth

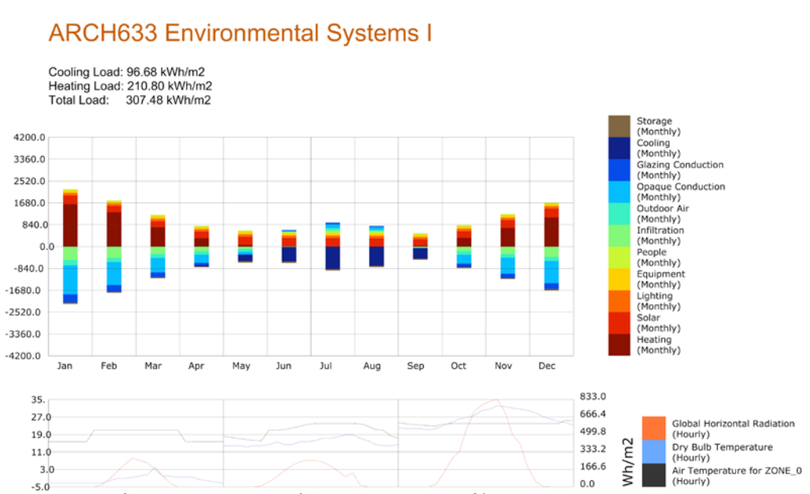




Compared with “default” setting, under the same circumstance, the **deaper blinds depth**, **the lower total loads** building will have.

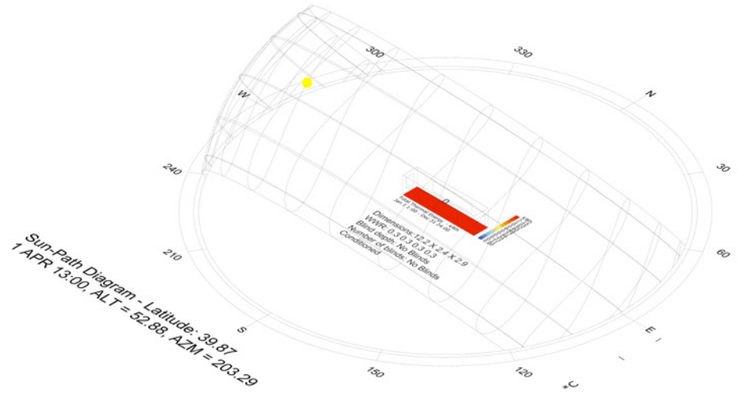
Blinds depth 0

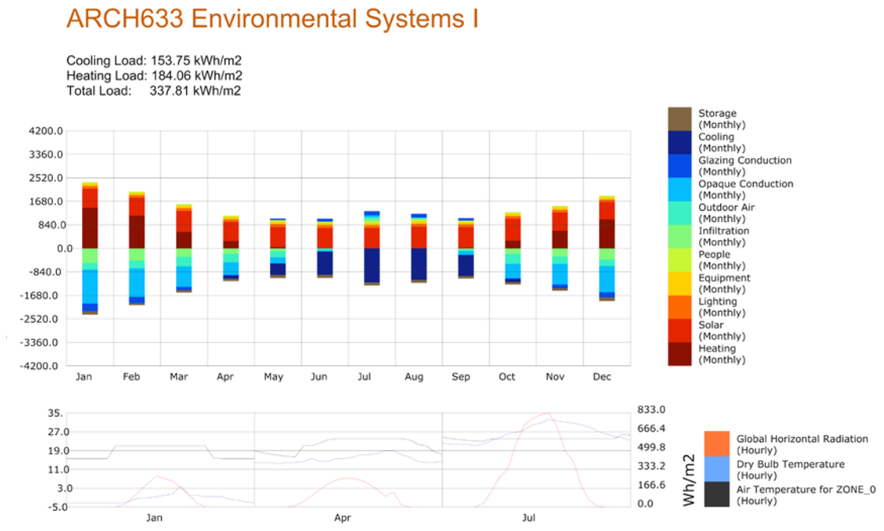




Blinds depth 0.7

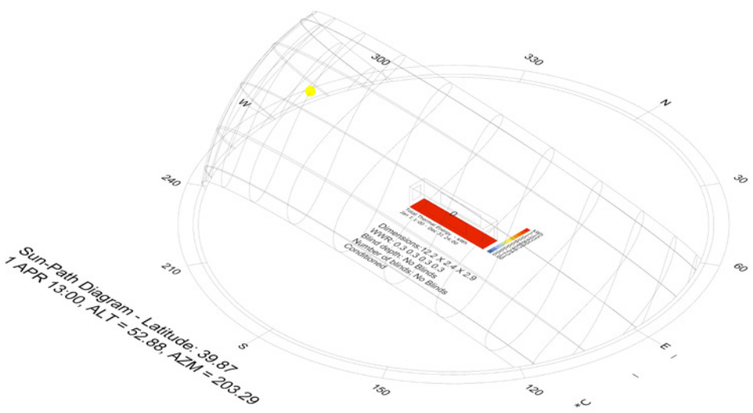
3. Thermal Mass

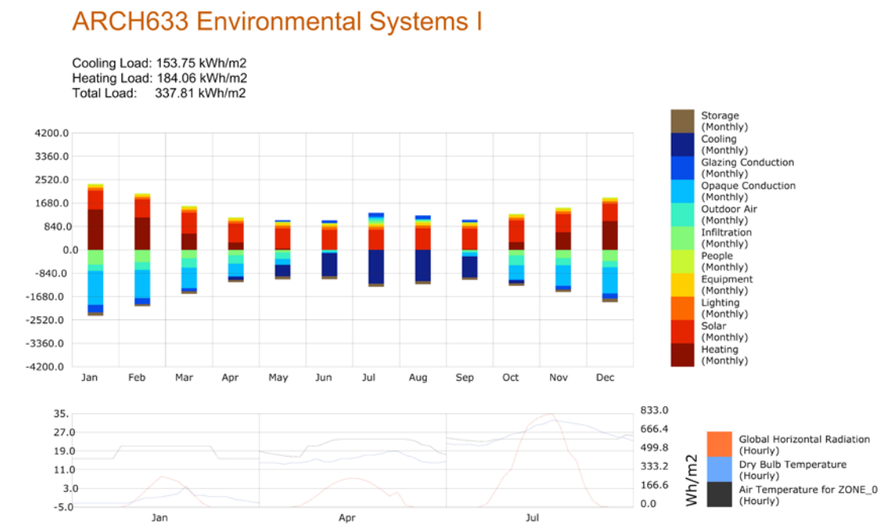




Compared with “default” setting, under the same circumstance, thermal mass have little effect on influcing total load.

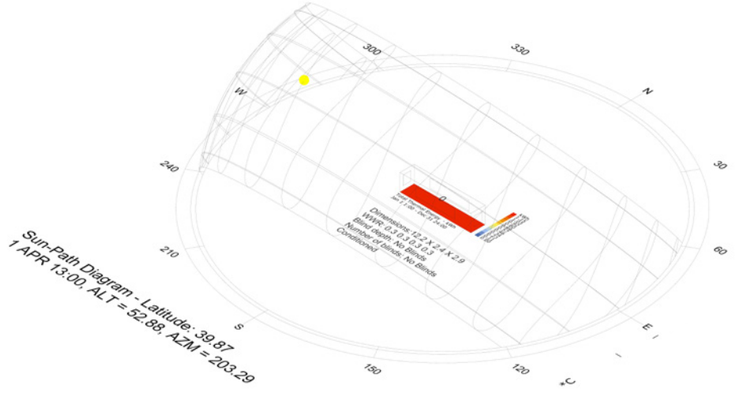
Without thermal mass

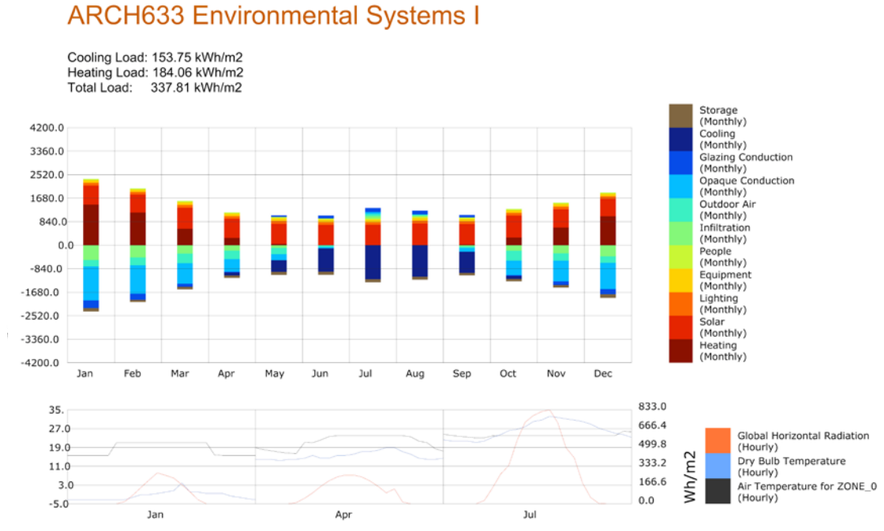




With thermal mass

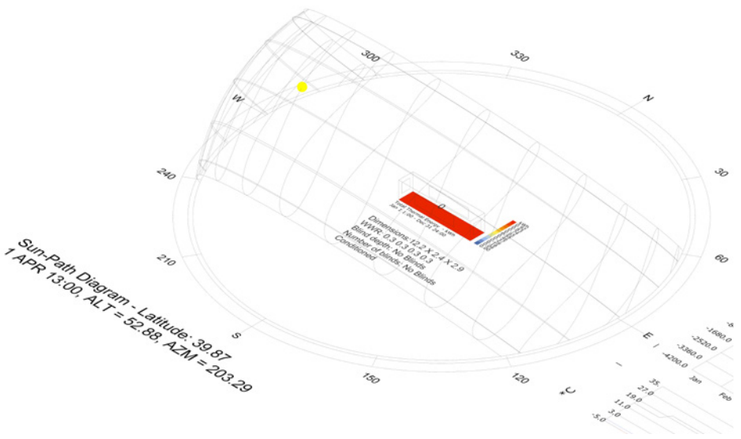
4. Building Structure

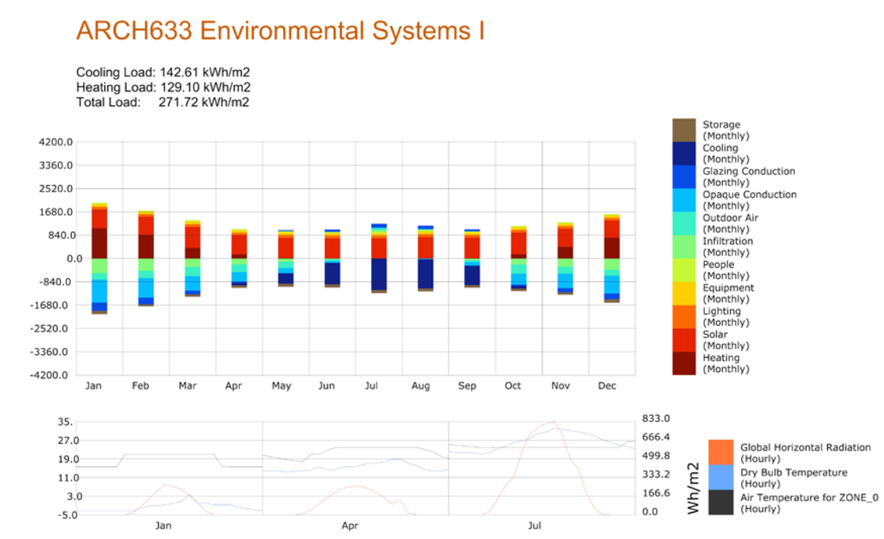




Compared with “default” setting, under the same circumstance, the different building struture have different effect on building’s total load.

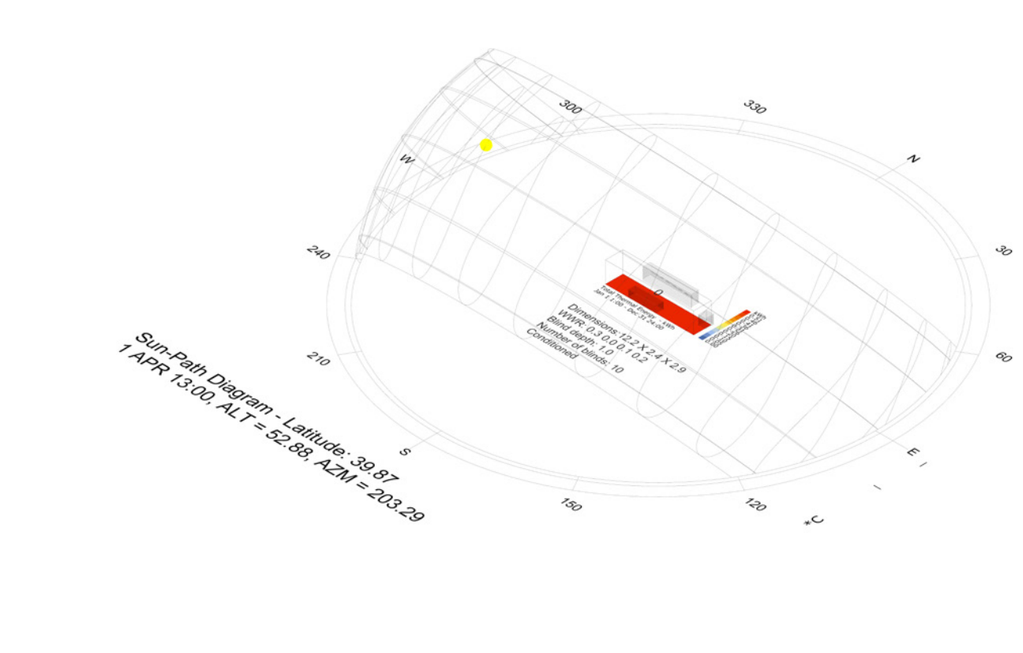
The higher R-value of structure element, the better thermal resistance of the building. However, passive house system **not only need to meet the goal of increase thermal resistance(heating load), but also need to consider the cooling load.** In this perticular case, in order to reach a better total load, window’s R-value need to be decresed.

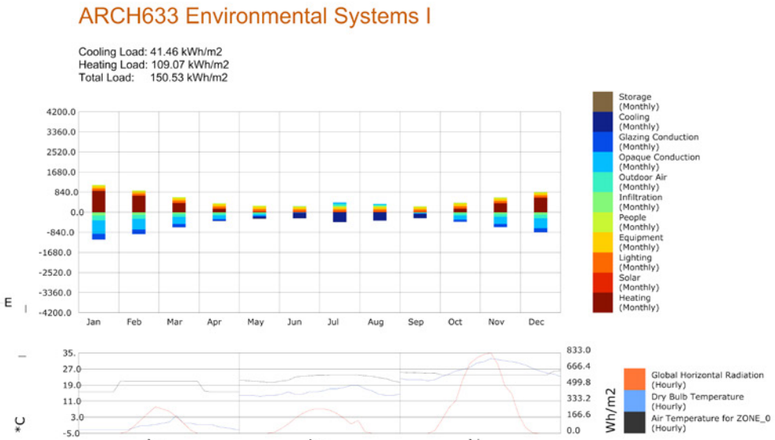




Higher Wall R-value structrue

FINAL DESIGN





Design priciple

Main Goal: Increase cooling load, decrease heating load, reach lower total load

According to the analysis above
1. Decrease the window ratio in South and West direction, Increase window ration in East and North direction. Because accoring to the data analysized and previous assignment, The south and west direction usually overheat.The north window can increase cooling load.

2. Increase the blinds number and depth. Blinds funtion as the shading device which can decrease solar heat gain and decrease heating load.

3. Change wall, roof and window structure. Higher R-value of wall and roof. Lower R-value of window. Decrease air change value. The structure of roof and wall should funtion as a better heat resistant element, while window should funtions as the element to increase cooling load. Moreover, the overall air change time should also be considered.