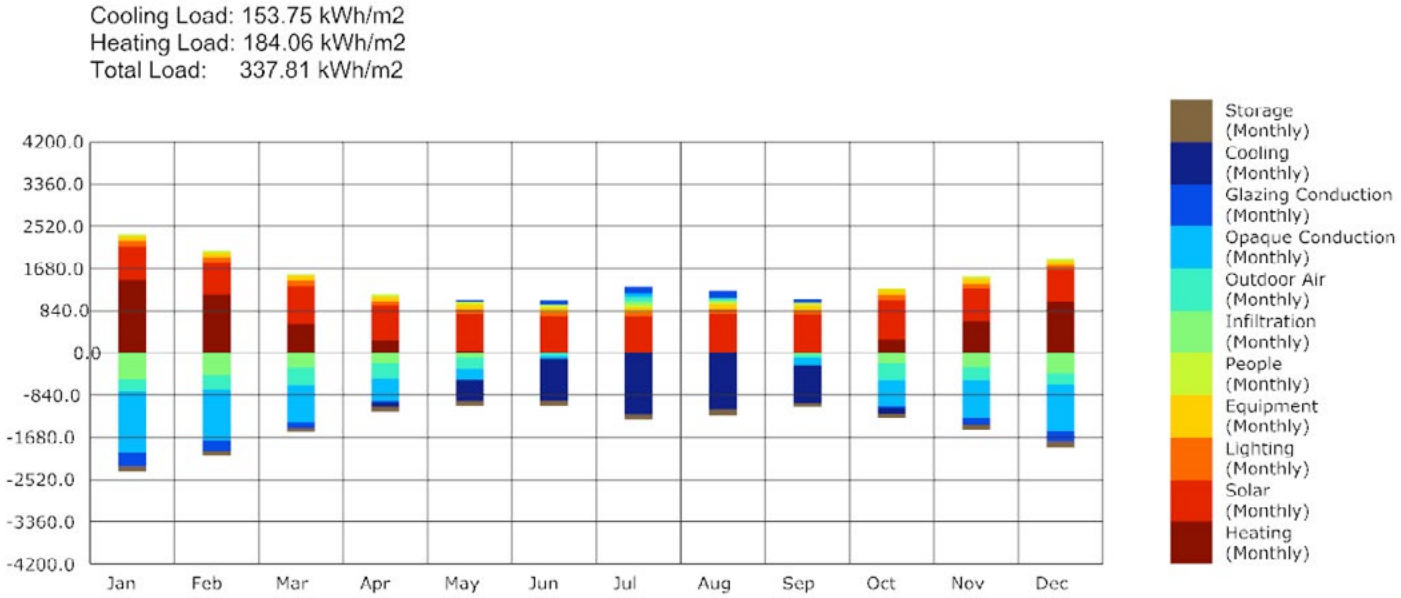
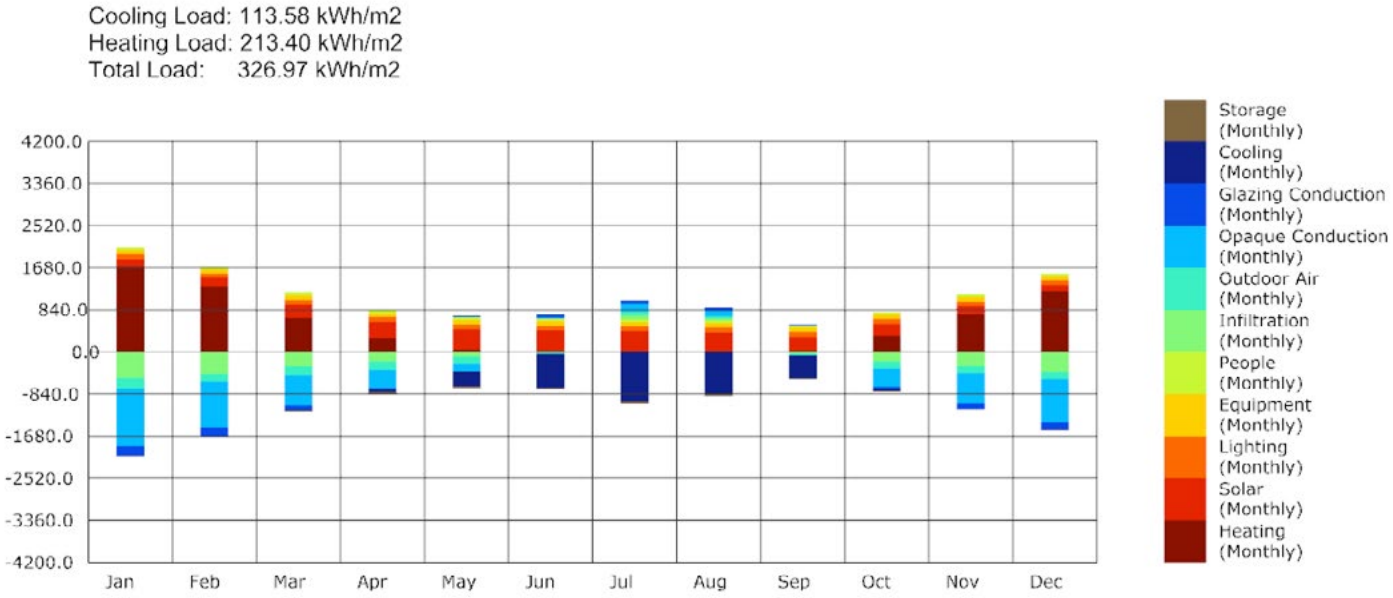
ENERGY BALANCE REPORT

ORIGINAL SETTING



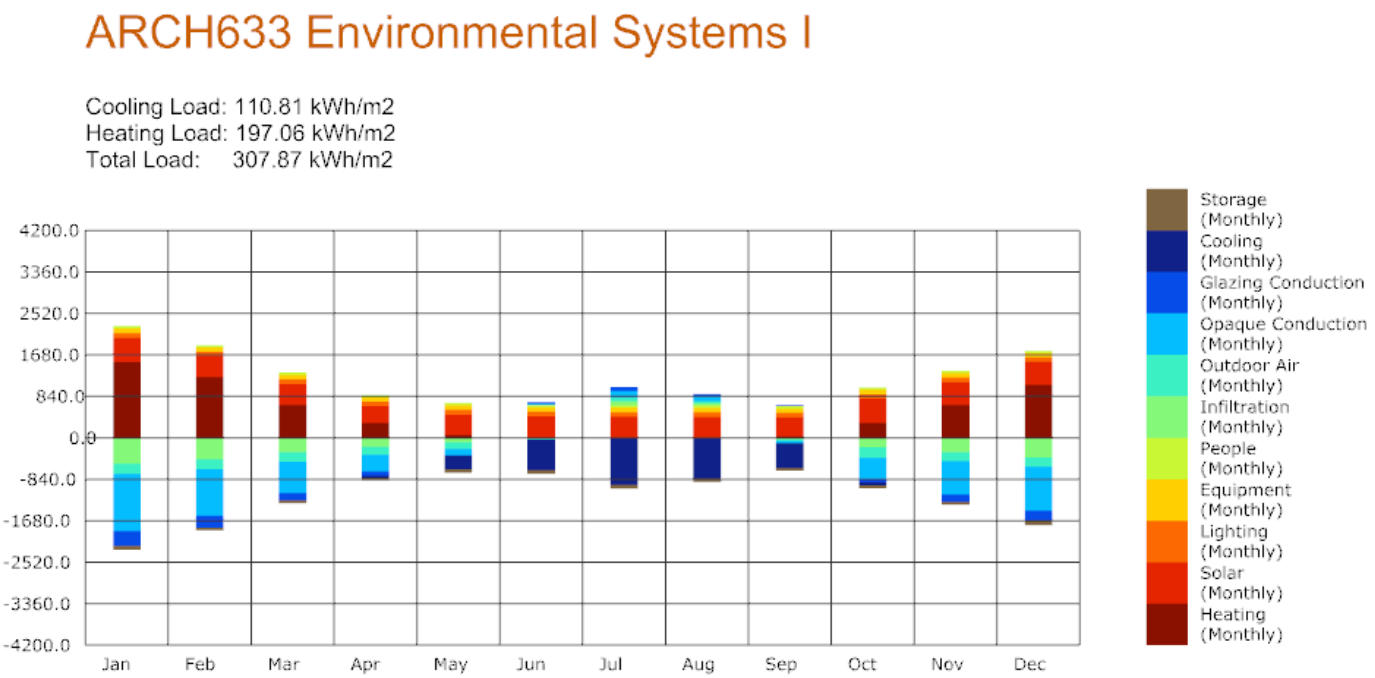
With the building system on, all the wall to window ratio is 0.3, no blinds, exterior wall R5.5, window R0.7, roof R9.2, air change hour2,the cooling load of the building is 153.75, heating load is 184.06, total load is 337.81. I assume by changing the window ratio of the wall facing south, the heating load and cooling load gonna change a lot, since most of the radiation is from south. By changing the south side window to smaller size, during summer, cooling load going to reduce, however, during winter, heating load may increase.

CHANGE 1



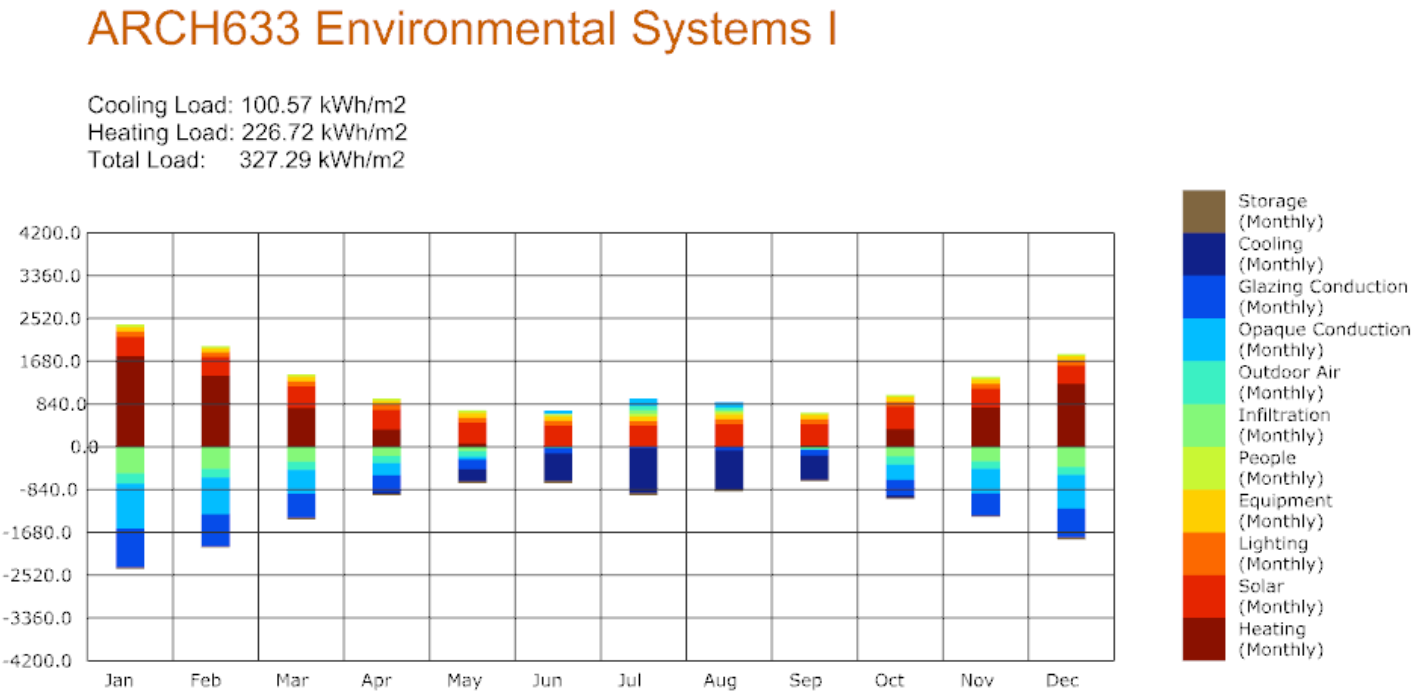
So, after the test of keep other perimeter the same, only change south side window ratio to 0, the cooling load is decreased from 153.75 to 113.58, the heating load is increased from 184.06 to 213.4, same as the expectation. Total load is only decreased a little.

CHANGE 2



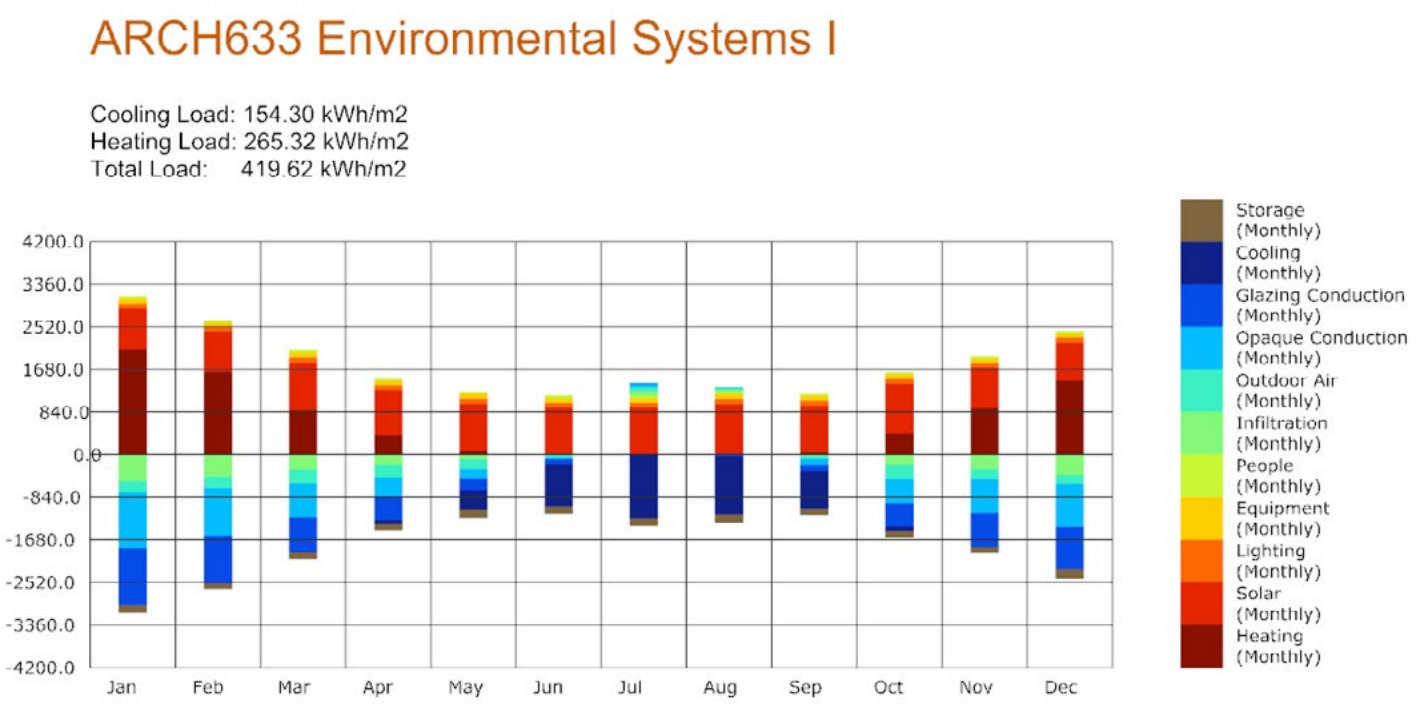
By changing all the wall to window ratio back to 0.3, and enable the blinds with 3 blinds and shading depth 0.3, cooling load is reduced by 1/3 of its original, heating load is increased a little. So the total load decreased a lot more compare to erase the window on the south side. Blinds can still let the sun in during the winter even though not as much as no blinds, and the shade can block most of the sun light during the summer. Therefore the cooling is reduced a lot while heating is increased a bit. Having blinds is an efficient way to reduce the building total load.

CHANGE 3



By turning off the blind, and keep other perimeter the same, changing exterior wall R value to 7.2. exterior roof R to 14.8, exterior window R to 1.7, the cooling load is reduce even more, and heating load increased a lot compare to using blind. The total load is reduced a little from 337.81 to 327.29. So compare to using blind, increase the R value of roof, wall and window is less efficient, even though the R value is unrealistic high.

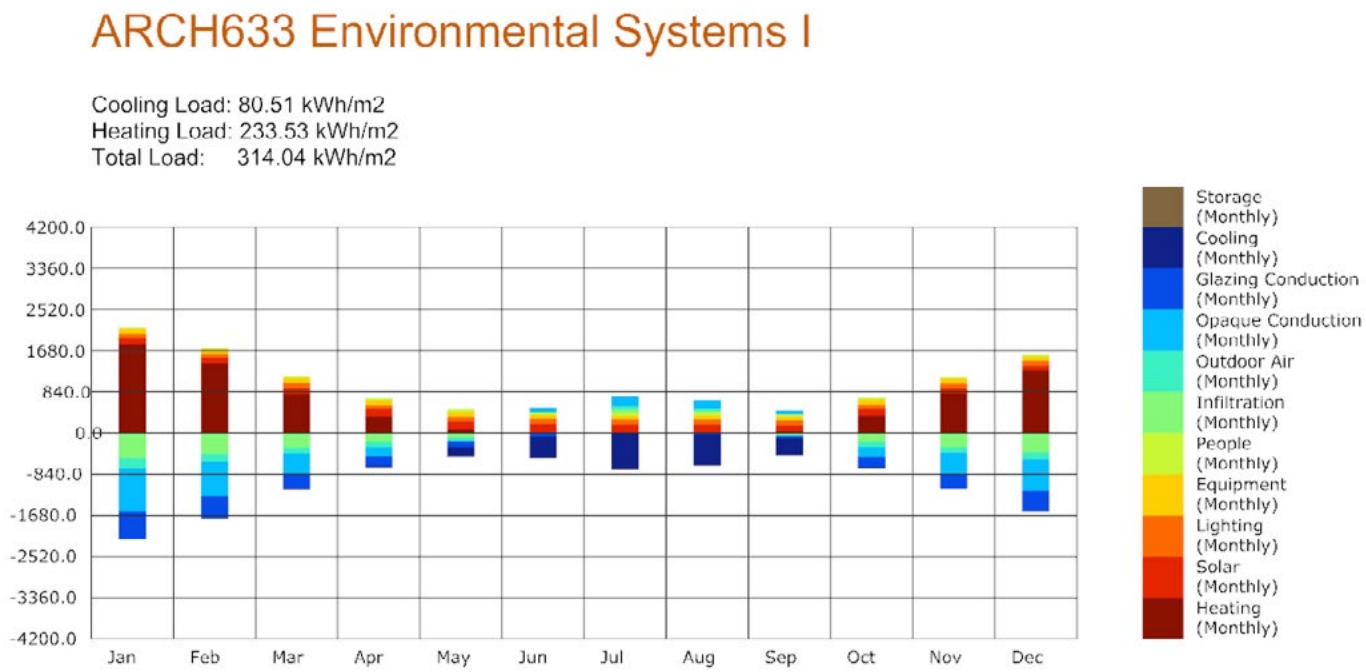
CHANGE 4



Set all the setting back the original, only changing the thermal mass to 8 inches concrete, the cooling load is barely changed, heating load is increased a lot as concrete absorb a lot heating as it goes thick. Change the thermal mass is not an efficient way to reduce total load.

All in all, by comparing changing window wall ratio, R value of building enclosure, adding blind, and changing thermal mass, the best way to reduce the total load of building is using blind. Window shading devices reduce solar heat gain while transmitting enough daylight to help reduce the use of artificial lighting and its resulting cooling loads.

CHANGE 5



For this test, I try to reduce the south wall window ratio from 0.3 to 0, increasing the R value of building enclosure, adding shading device, the cooling load is decreased a lot, heating load increased. the total value is decreased a bit. However, it is not as efficient as only changing the shading device. I feel heating load and cooling load couldn't decrease at the same time.