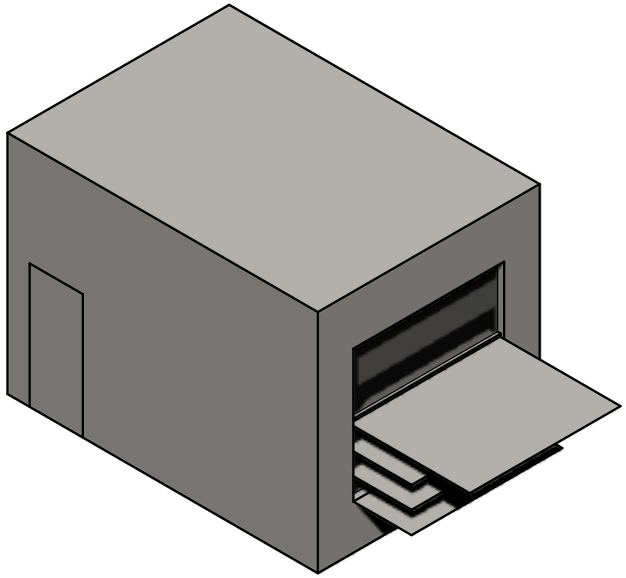
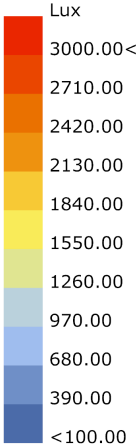
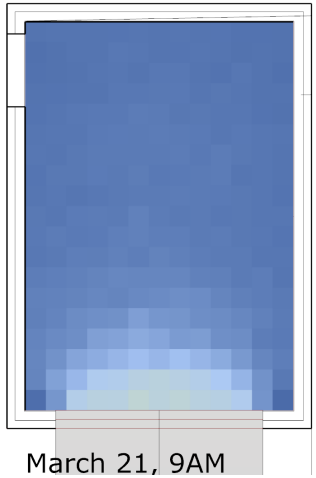
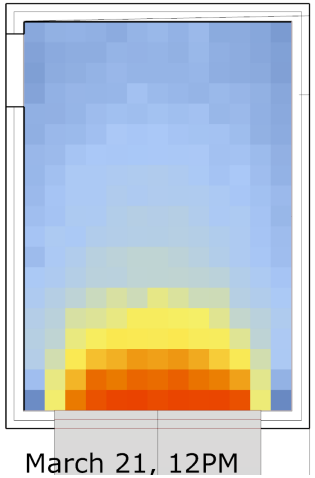
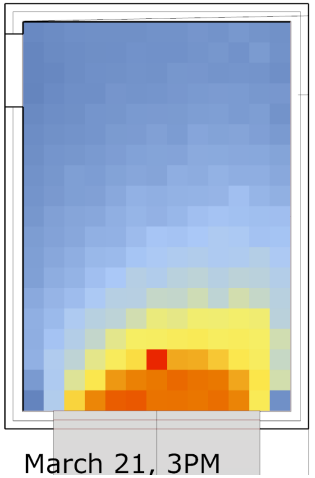
Proposed Strategy

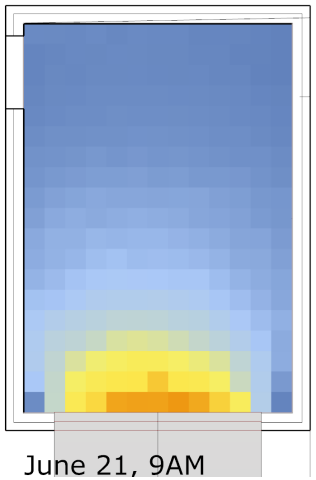


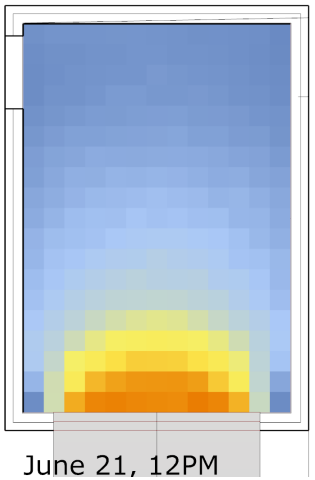


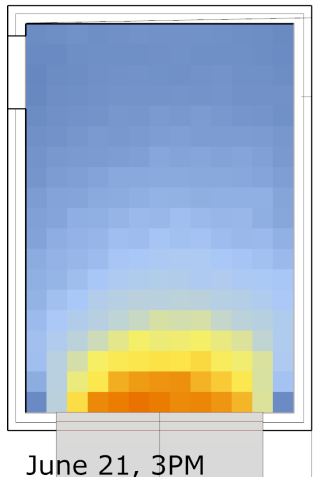


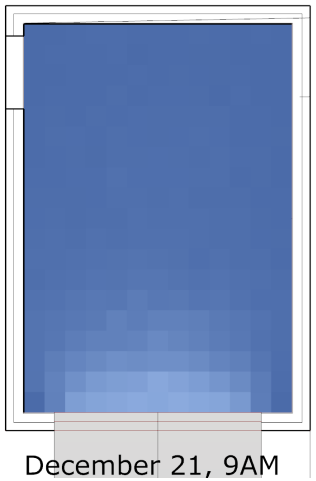


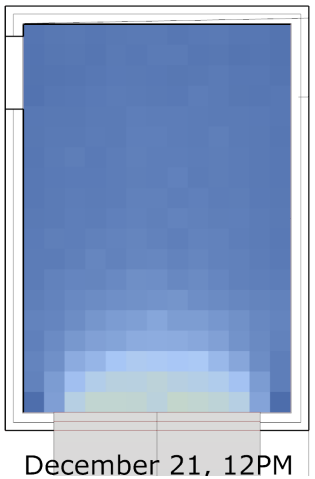


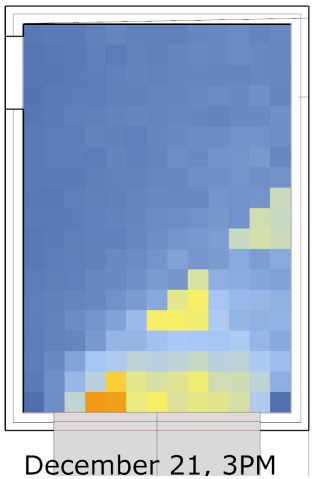






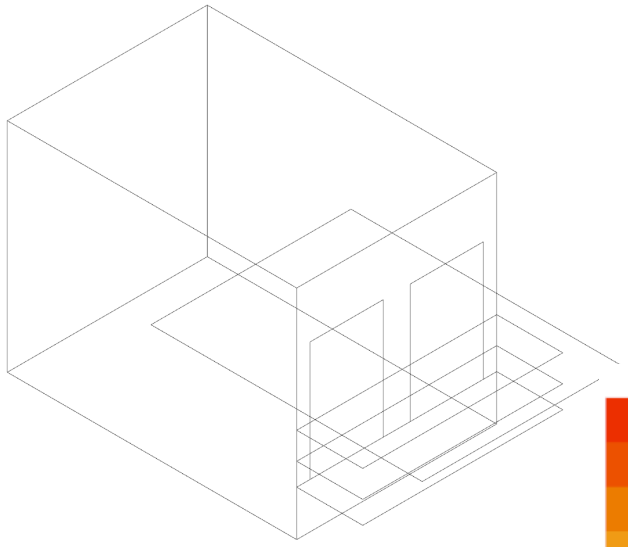


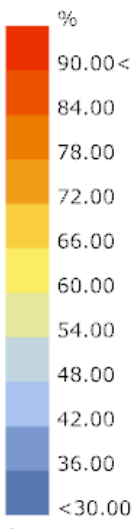




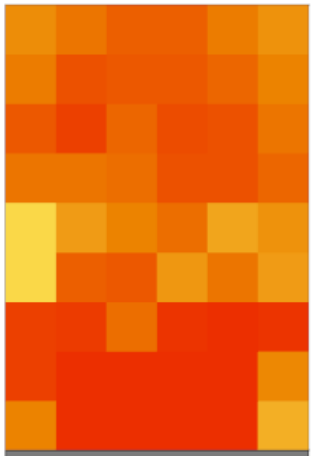
With knowledge gained through previous studies of illuminance it is known this room has issues with light reaching deep inside. The images to the right which were previously run demonstrate changes already made, Here the window to wall ratio is 50%. it is clear that there is excess light in the front of the room and that while the back get some it is generally on the lower side.

Window to Wall Ratio with Shading

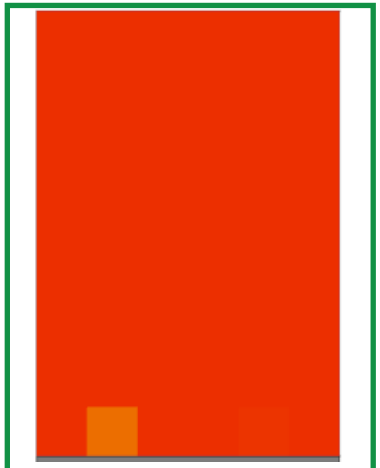




Window to Wall Ratio: 0.4



Window to Wall Ratio: 0.2



Window to Wall Ratio: 0.4

Window to Wall Ratio: 0.7

Window to Wall Ratio: 0.3

Window to Wall Ratio: 0.5

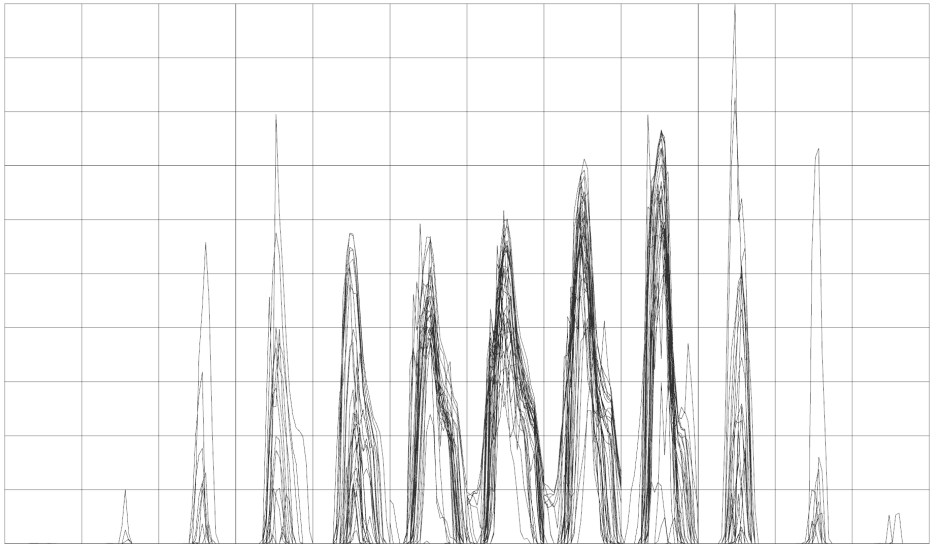
Window to Wall Ratio: 0.8

Window to Wall Ratio: 0.6

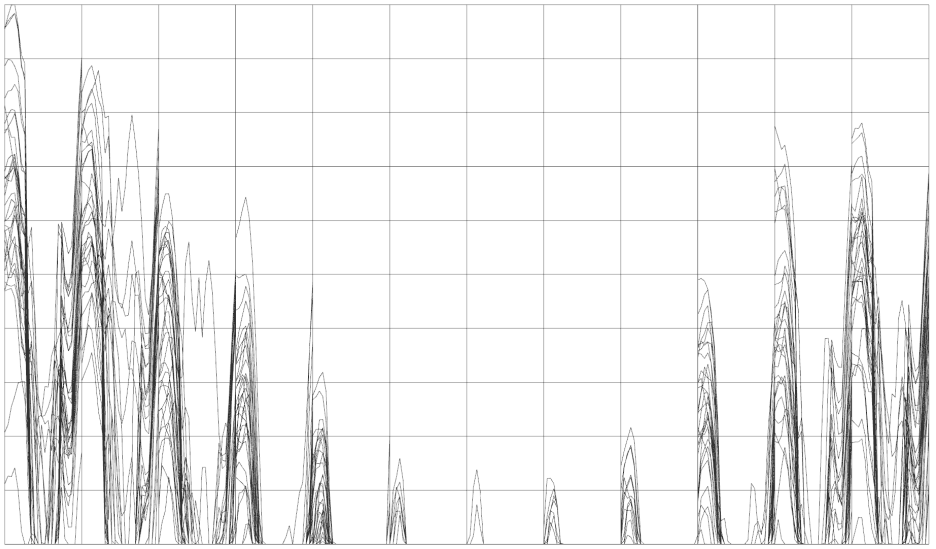
Window to Wall Ratio: 0.9

The shading devices already proposed are clearly helpful for keeping the illuminance within the range specified by UDI. Looking at the images to the right it is clear that a window to wall ratio of 40% provides a UDI which is ideal for the vast majority of the room for over 90% of the time. This along with the illuminance being generally over 300 Lux in the previous image suggests that this is a good solution

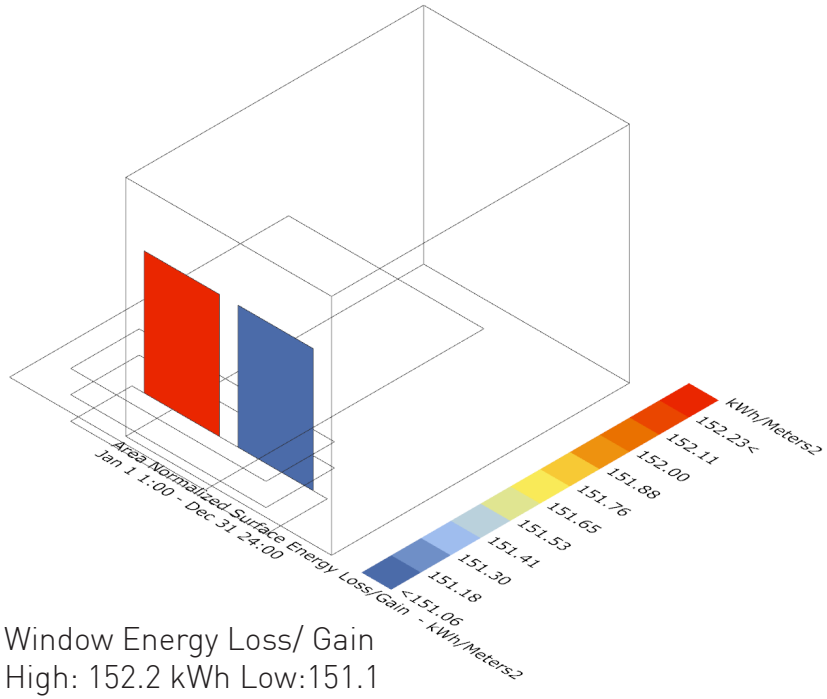
Energy Analysis



Cooling Load for Room
Total of 960.9 kWh/ year



Heating Load for Room
Total of 534.9 kWh/ year



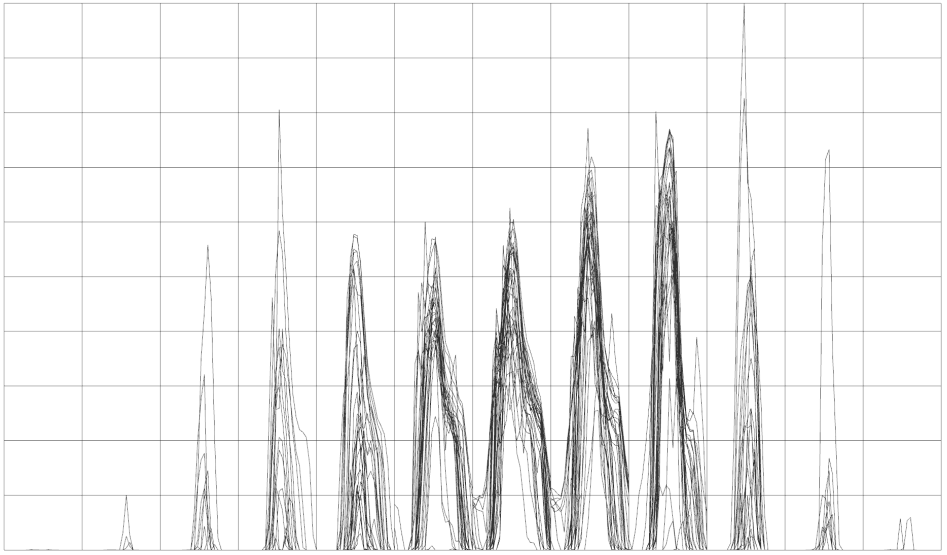
Window Energy Loss/ Gain
High: 152.2 kWh Low:151.1

R-Values (h ft^2 ° F/ BTU):
Wall: 13
Ceiling: 25
Floor: 25
Window: 1

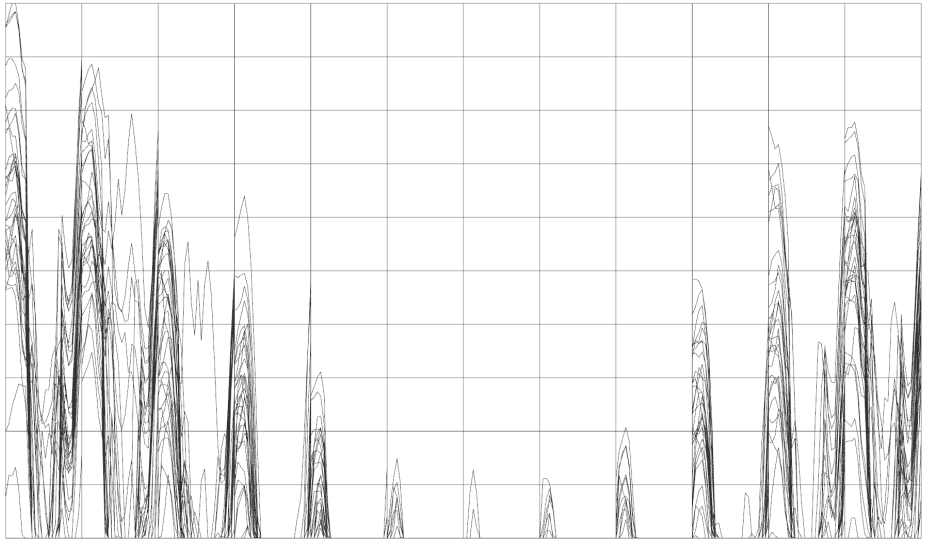
With this room as a part of a larger, older building, these measurements seem generally reasonable. The EUI of 48.4 for the heating and cooling of the building seems if anything on the lower side due to the inefficiencies of an older building. However as this is an idealized model and not taking into account drafts and other inefficiencies or devices inside the home it does seem reasonable. Additionally the electric split unit does not pull in fresh air so the heat which is not lost to construction is generally recycled. Finally, This room being a part of a larger building reduces the opportunities for heat loss or gain.

However, when doing this assignment I had issues with forming a bar graph. The graphs above for heating and cooling load seem reasonable and the final numbers correct but could not achieve the proper visualization. Any insight into what the issue may be would be appreciated.

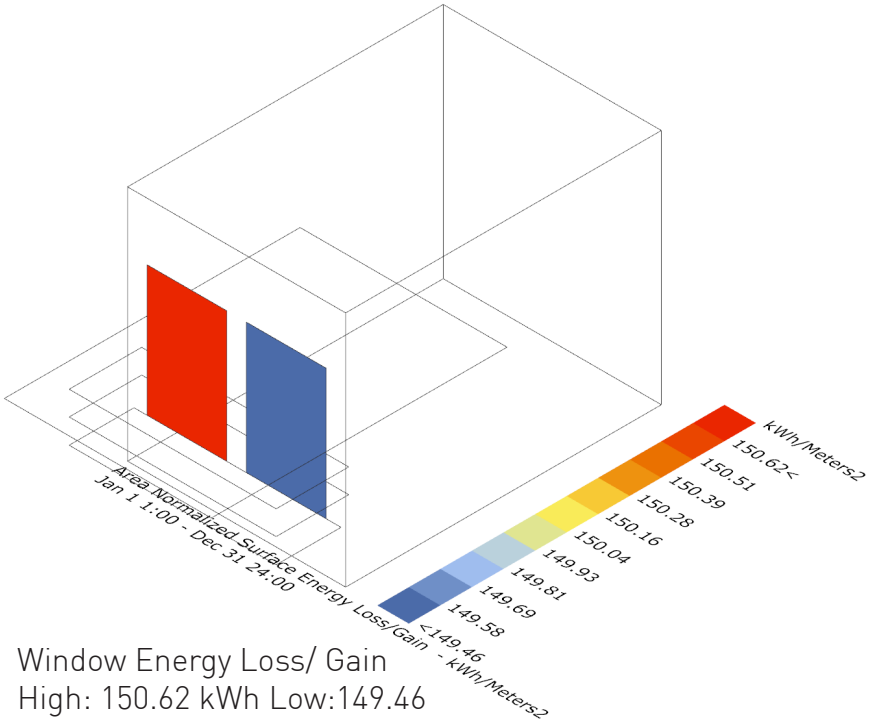
Proposed Energy Analysis



Cooling Load for Room
Total of 945.5 kWh/ year



Heating Load for Room
Total of 465.1 kWh/ year



Window Energy Loss/ Gain
High: 150.62 kWh Low:149.46

Proposed R-Values (h ft^2 $^\circ$F/ BTU):
Wall: 26
Ceiling: 40
Floor: 38
Window: 6.5

Due to this room being part of a large building, there is not a great deal which can be done to reduce issues of this idealized energy load. By changing the materials exposed to the exterior on the south, the wall and glazing, the cooling load was brought down about 15 kWh/yr and the heating about 70 kWh/yr. Additionally the overall EUI was brought down 1.65 kBTU/sf to 46.75 and the average energy gain by 1.61 kWhr/m2. It is expected that one a more in depth model is made, the possible impacts of improving instruction will be better seen.