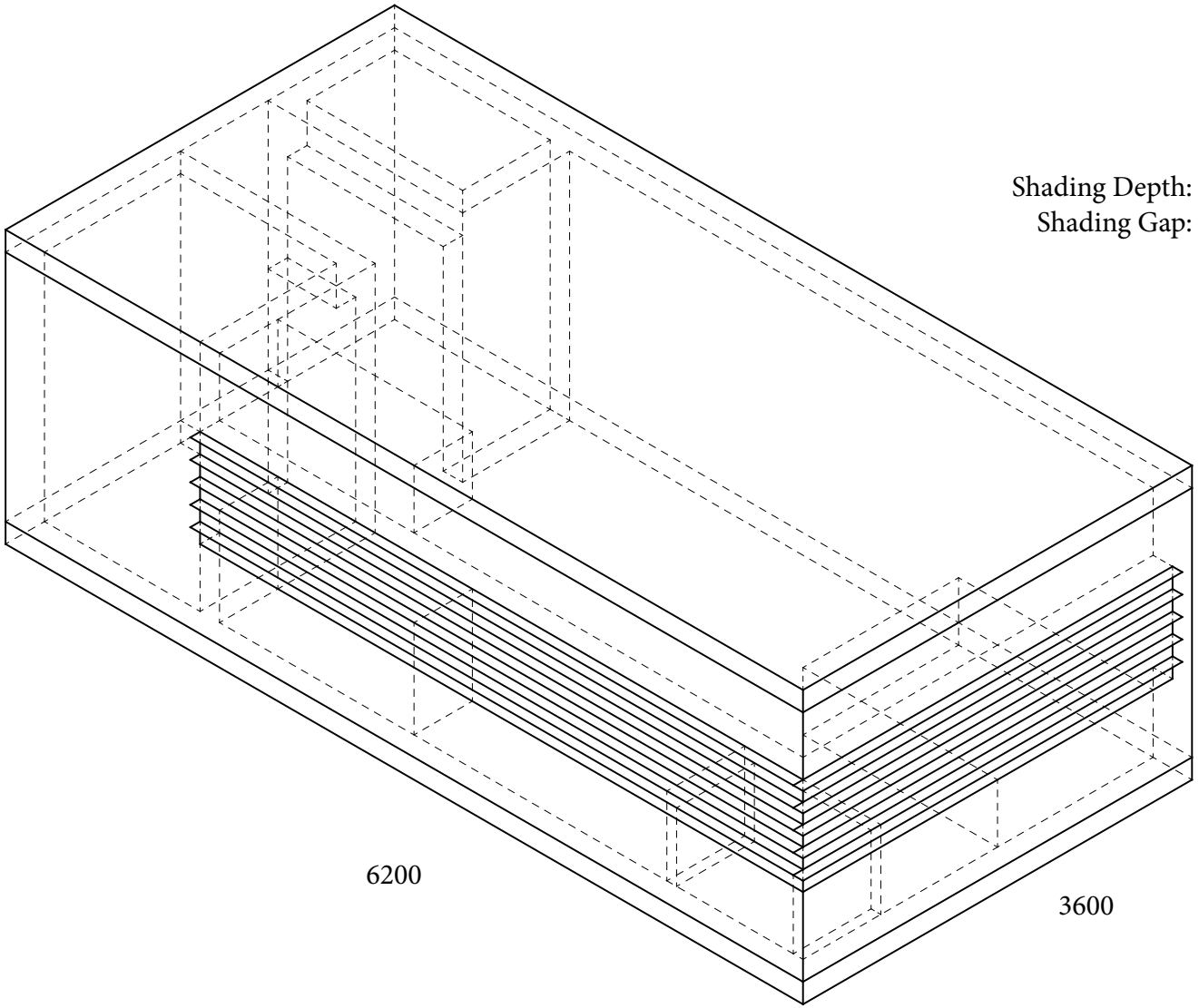
Energy Simulation

171106 Assignment_6
DREAM ROOM in Philadelphia



Shading Depth: 100mm
Shading Gap: 200mm

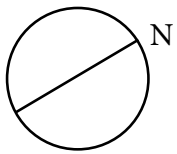
City: Philadelphia, PA

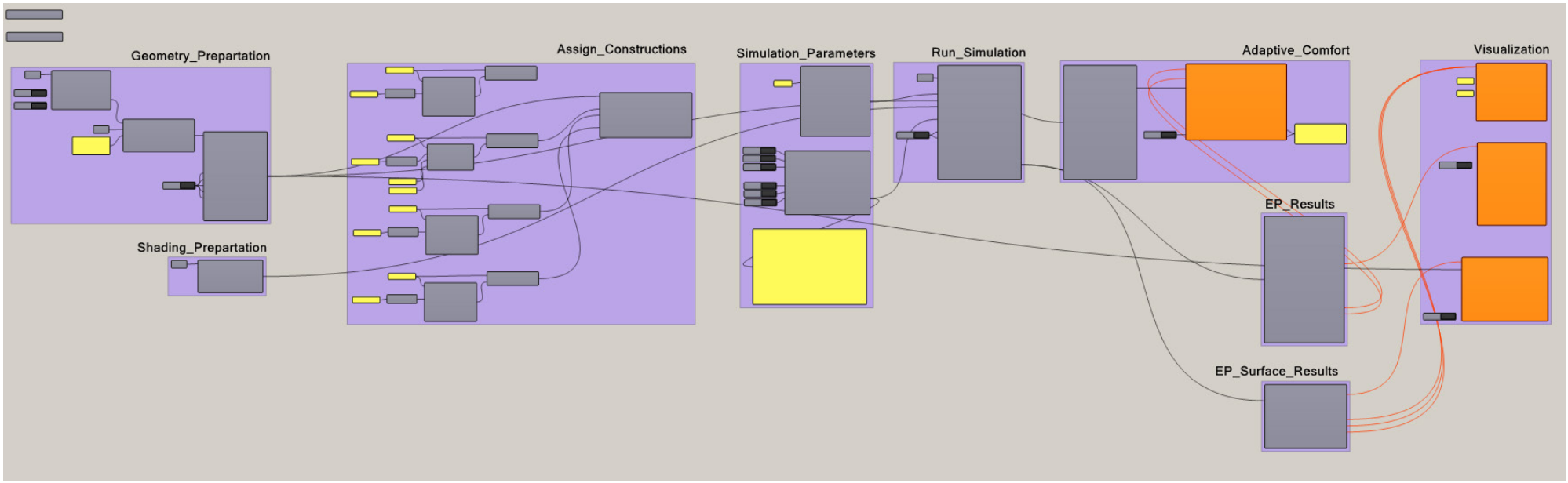
Latitude: 39.8683

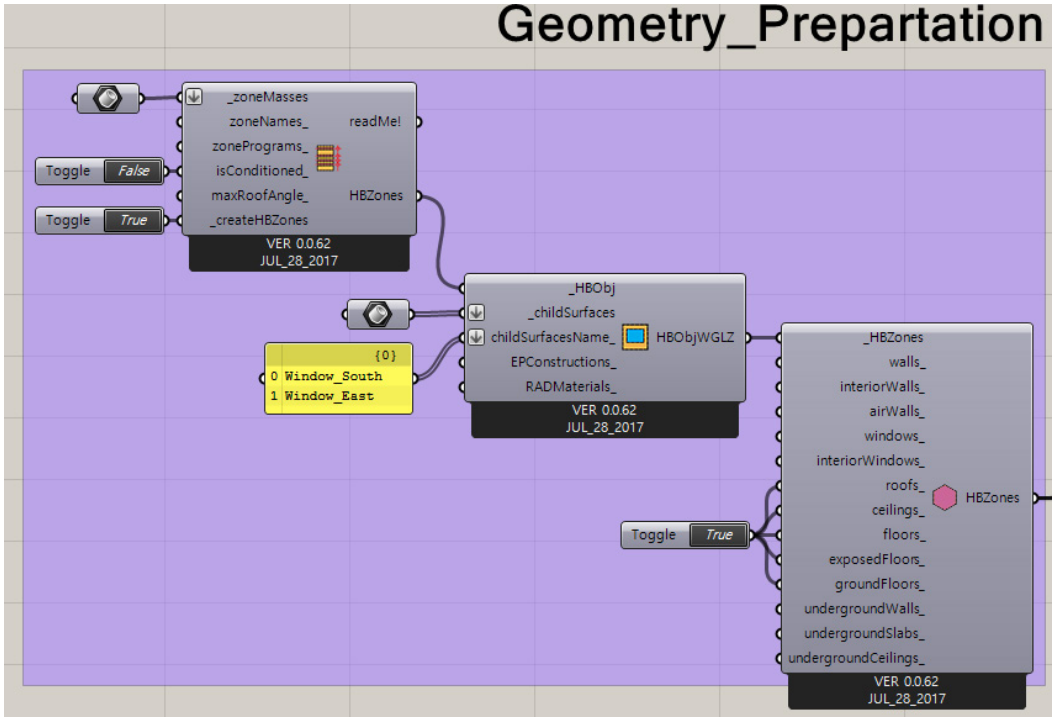
Longitude: -75.2311

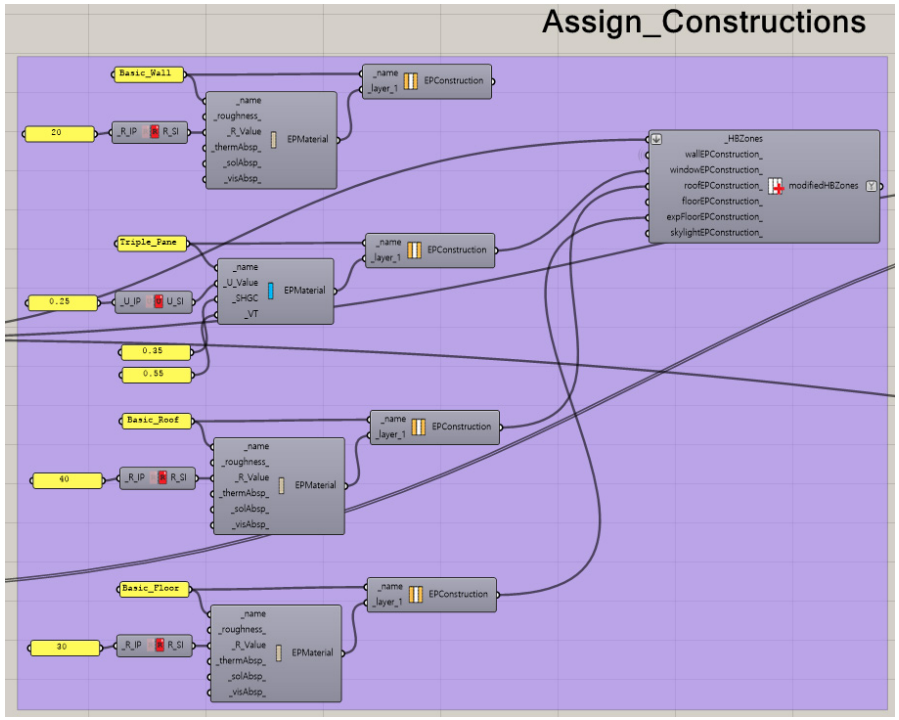
Climate:
According to the Köppen climate classification, Philadelphia falls under the northern periphery of the humid subtropical climate zone (Köppen Cfa),[71] whereas according to the Trewartha climate classification, the city has a temperate maritime climate (Do).[72] Summers are typically hot and muggy, fall and spring are generally mild, and winter is cold. (Wikipedia)

Wind:
Generally, not too extreme, however, sometimes in winter, it's quite strong.

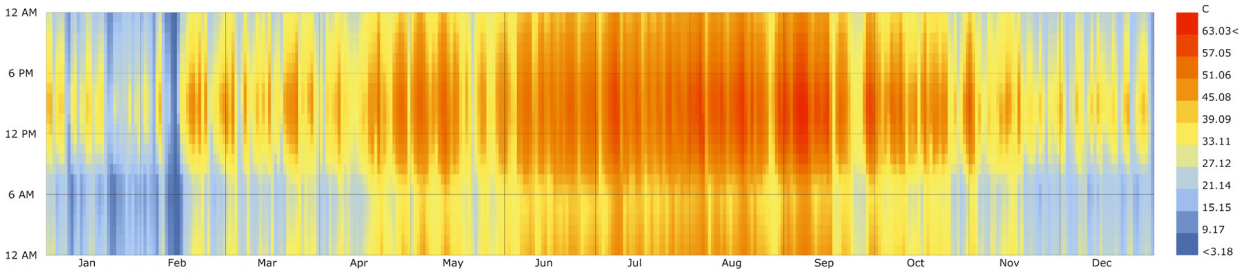




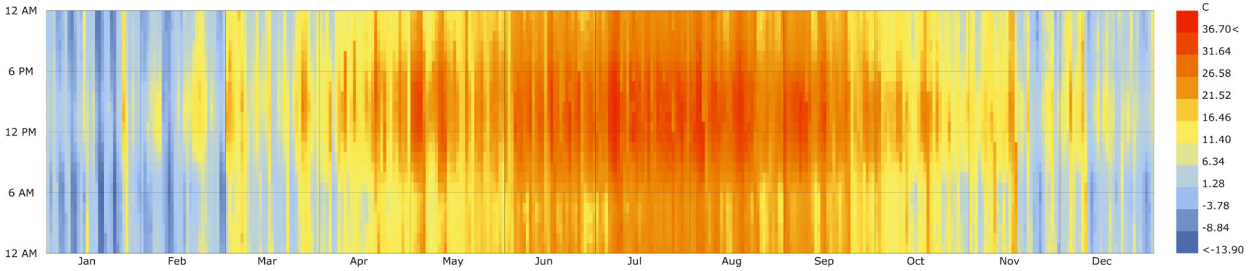




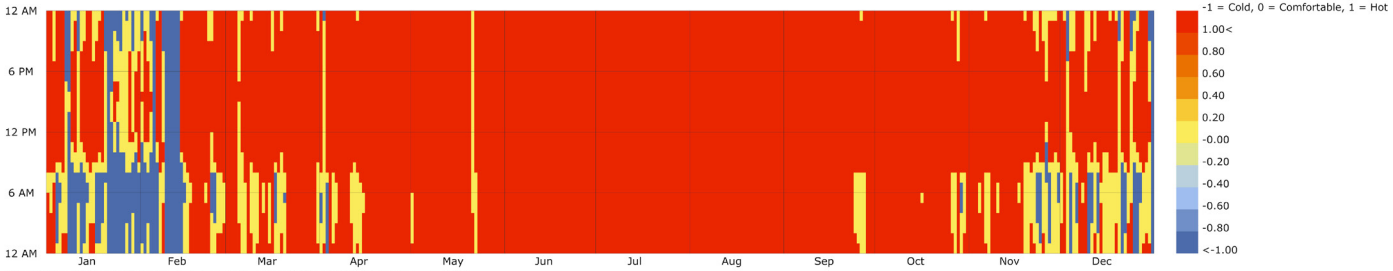
My overall strategy of this simulation is evaluating energy model of my dream room. What I examined is adamptive comfort, overall energy, and surface condition of the room. I tried to apply two windows in different orientations, and various construction conditions of each components of the room.



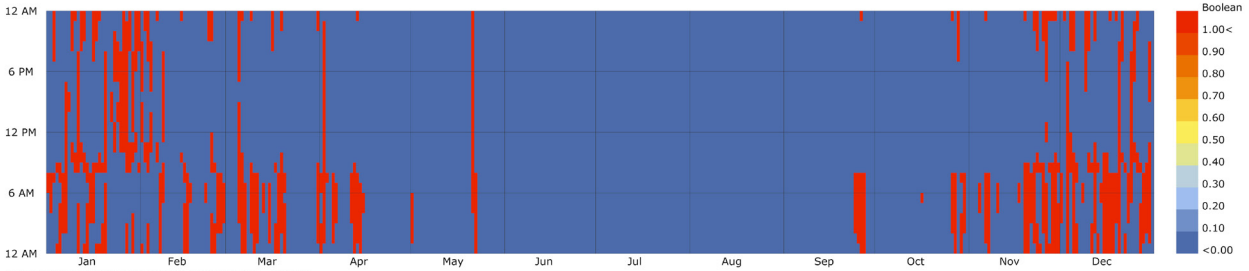
Air Temperature for ZONE_0 (C) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00



Dry Bulb Temperature (C) - Hourly
Philadelphia International Ap_PA_USA
1 JAN 1:00 - 31 DEC 24:00



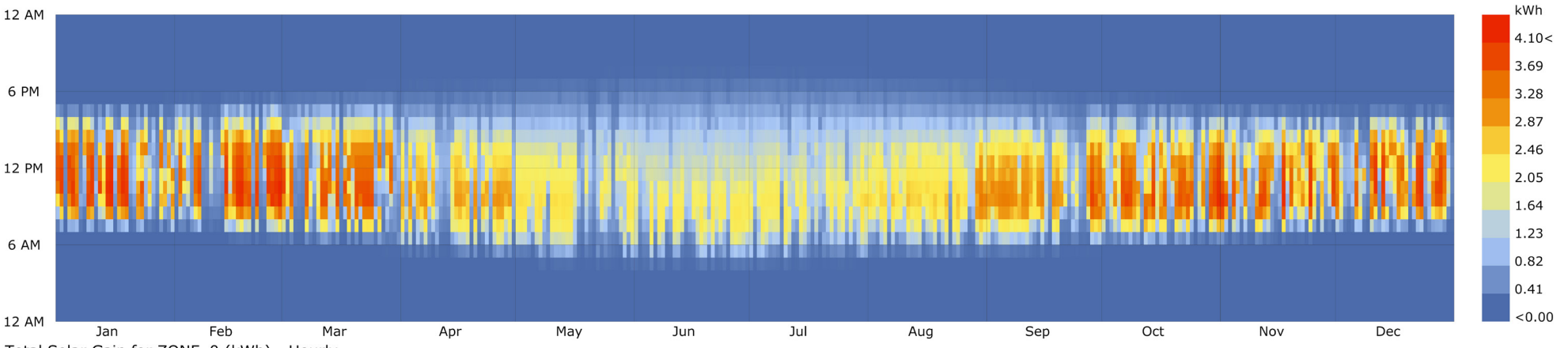
Adaptive Comfort for ZONE_0 (-1 = Cold, 0 = Comfortable, 1 = Hot) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00



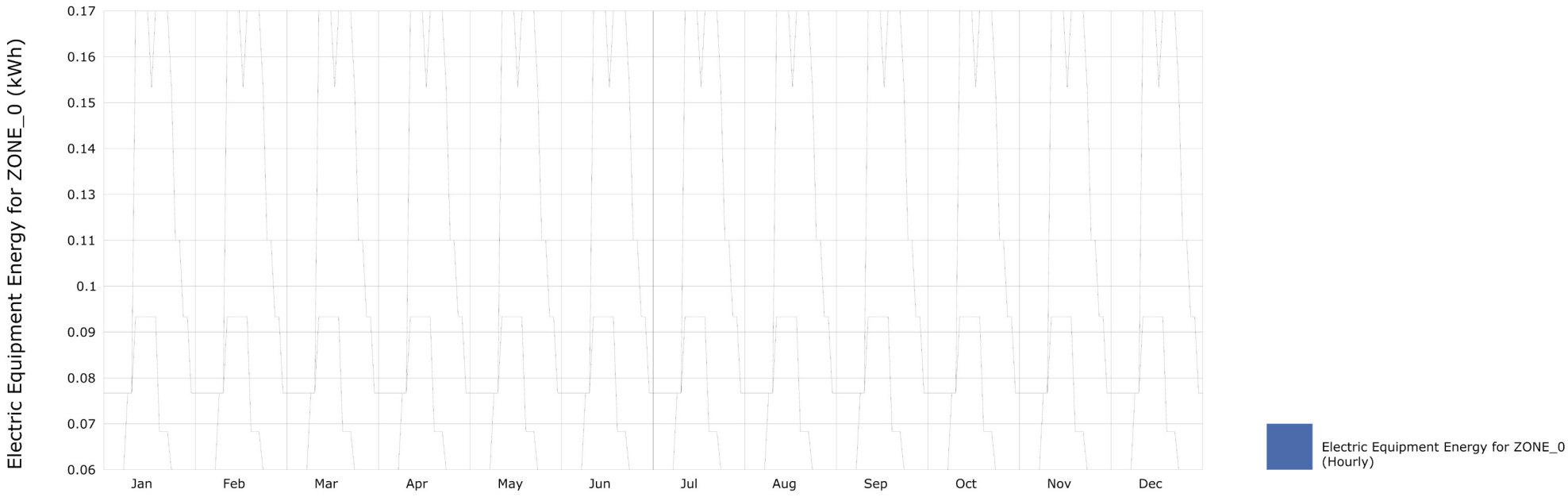
Comfortable Or Not for ZONE_0 (Boolean) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

Firstly, I've examined the air temperature of the room. The result was too high, so I've also checekd dry bulb temperature of the outside. Compare to the outside one, it's still too high, and I guess it is because ventilation is not applied in this model.

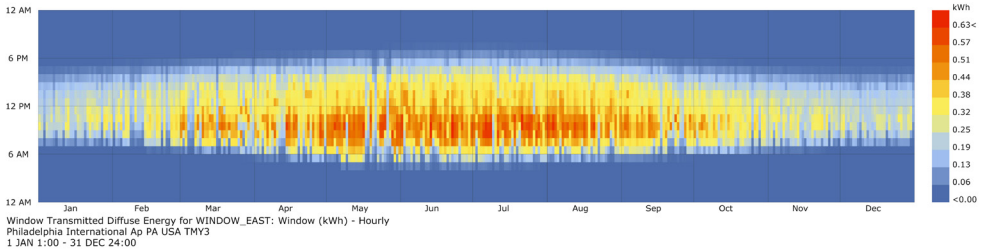
According to the results, comfort zone analysis is also extreme. Thus, mostly it is uncomfortable currently.



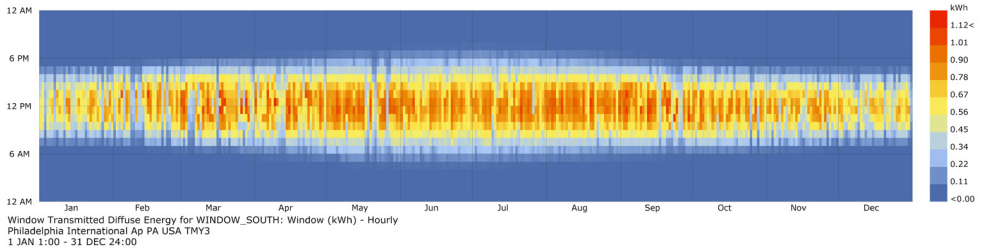
Total Solar Gain for ZONE_0 (kWh) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00



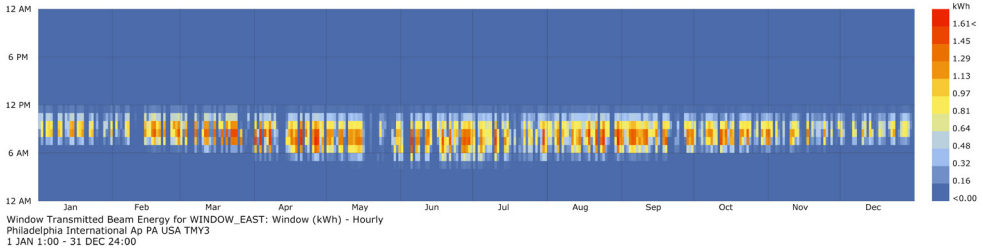
Second, the energy of solar gain and electric energy used are compared. Due to the window facing East and louvers, relatively low angle sun radiance comes into the room, so solar gain energy is higer in wintertime than summertime. This result seem positive for the passive house. Yet, still, ventilation is not considered in this model, so it was hard to measure accurate electric equipment energy usage.



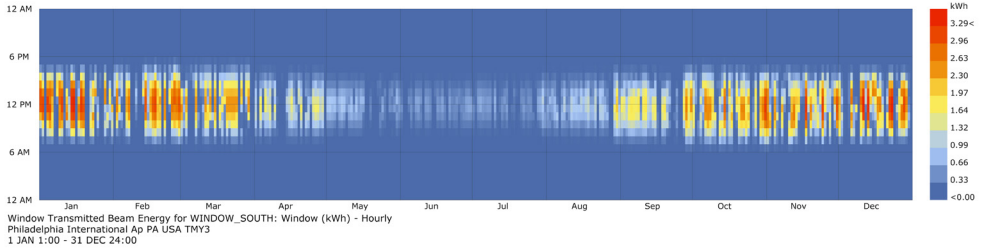
Window Transmitted Diffuse Energy for WINDOW_EAST: Window (kWh) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00



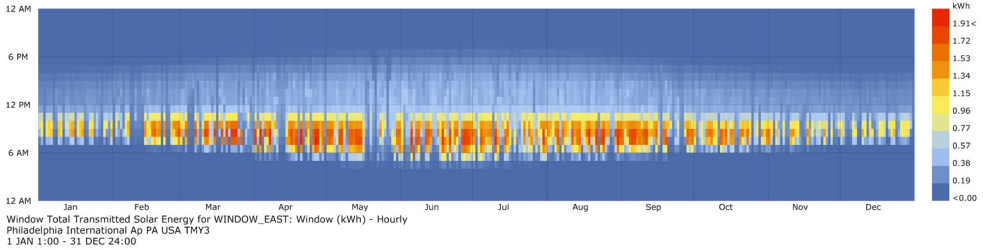
Window Transmitted Diffuse Energy for WINDOW_SOUTH: Window (kWh) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00



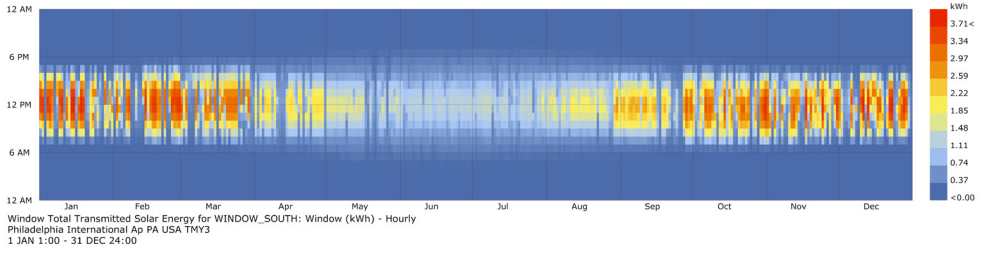
Window Transmitted Beam Energy for WINDOW_EAST: Window (kWh) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00



Window Transmitted Beam Energy for WINDOW_SOUTH: Window (kWh) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00



Window Total Transmitted Solar Energy for WINDOW_EAST: Window (kWh) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

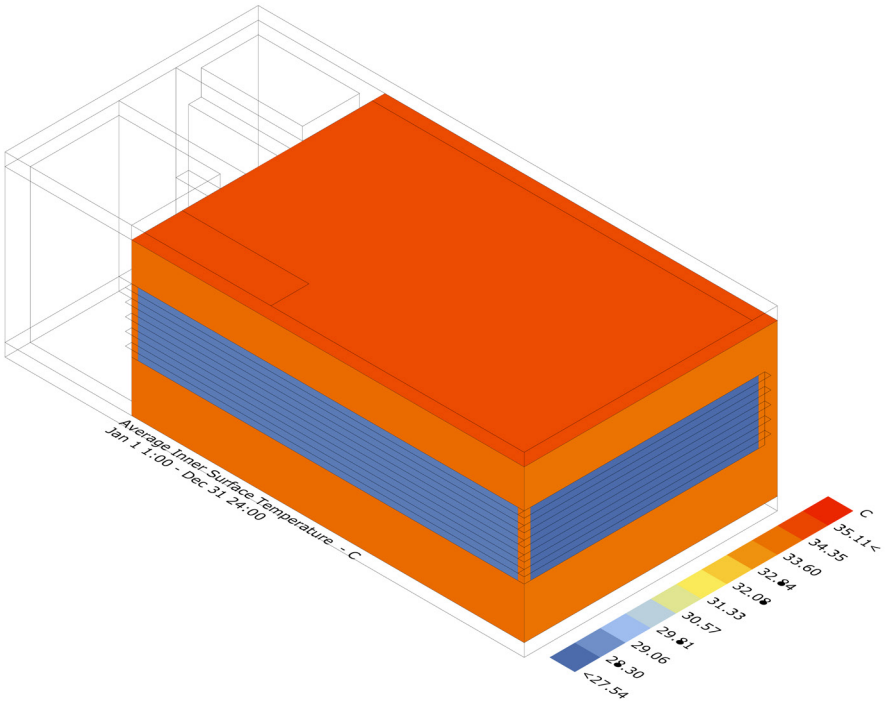


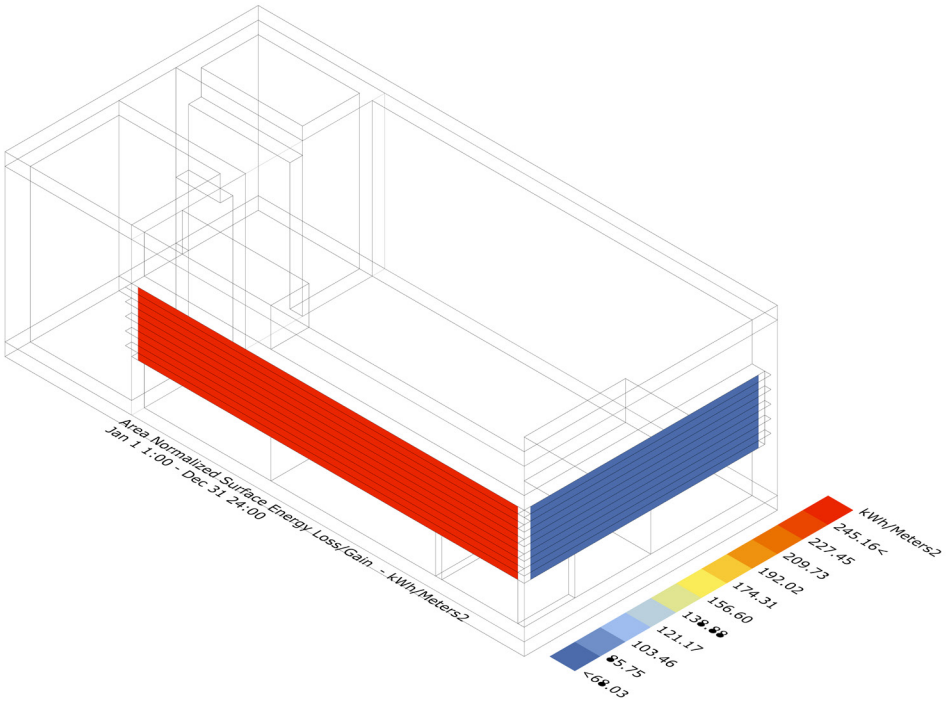
Window Total Transmitted Solar Energy for WINDOW_SOUTH: Window (kWh) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

Thirdly, transmitted diffuse energy, transmitted beam energy, and total transmitted solar energy through windows was evaluated. Even if the size of the South window is smaller than twice of the East window, overall energy gained is about twice.

Regarding the East window, energy gained in summer is not much but still higher than in winter. I guess this is because the louver is horizontal. Beam energy and total energy gained is usually high in the daytime before noon. Yet, I like intense morning energy to make me wake up, so this result is what I expected to achieve.

Concering the South window, energy gained through the window in summer is less than in winter, which means the louver functions properly. Also, during the whole year, diffuse energy is quite even, so energy distribution would be good.





Lastly, I examined energy related to the surfaces of the room and windows. Average inner surface temperature is quite high now. Considering the low energy gain, it is the result of not applying ventilation and infiltration. Thus, this simulation will be done again after applying those.

In area normalized surface energy loss and gain simulation, energy flow of the South window is more than three times than that of the East window. After ventilation is applied in this model, if it has severe problem, different glazing condition, such as better filming, should be considered to attain better result.