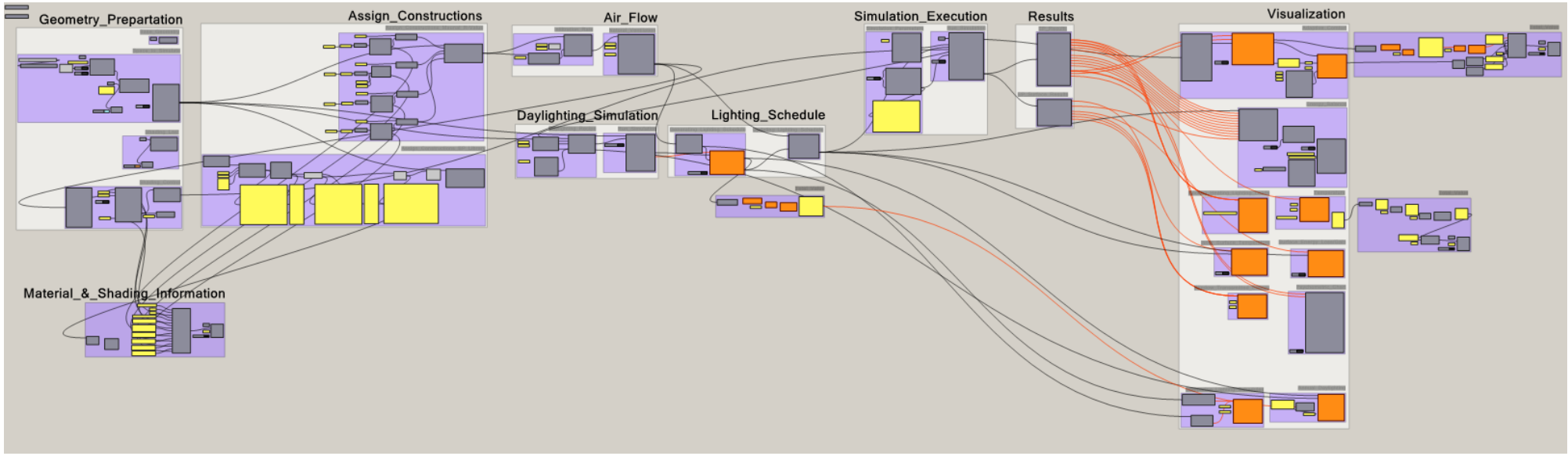
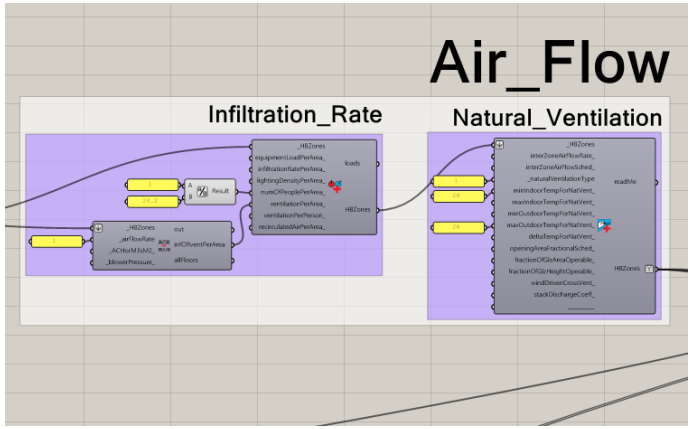
Itegrated Simulation

171120 Assignment_8
DREAM ROOM in Philadelphia



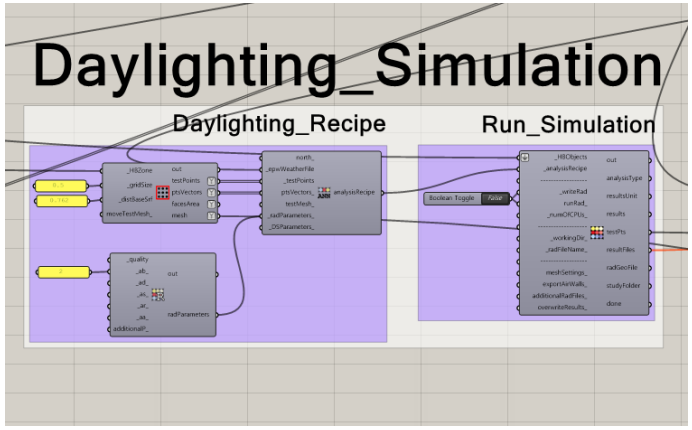


Infiltration Rate

Number of People: 1
Area 24.2

Ventilation Information

Type: Natural Ventilation
Min Indoor Temperature for Natural Ventilation: 20 C
Max Outdoor Temperature for Natural Ventilation: 28 C

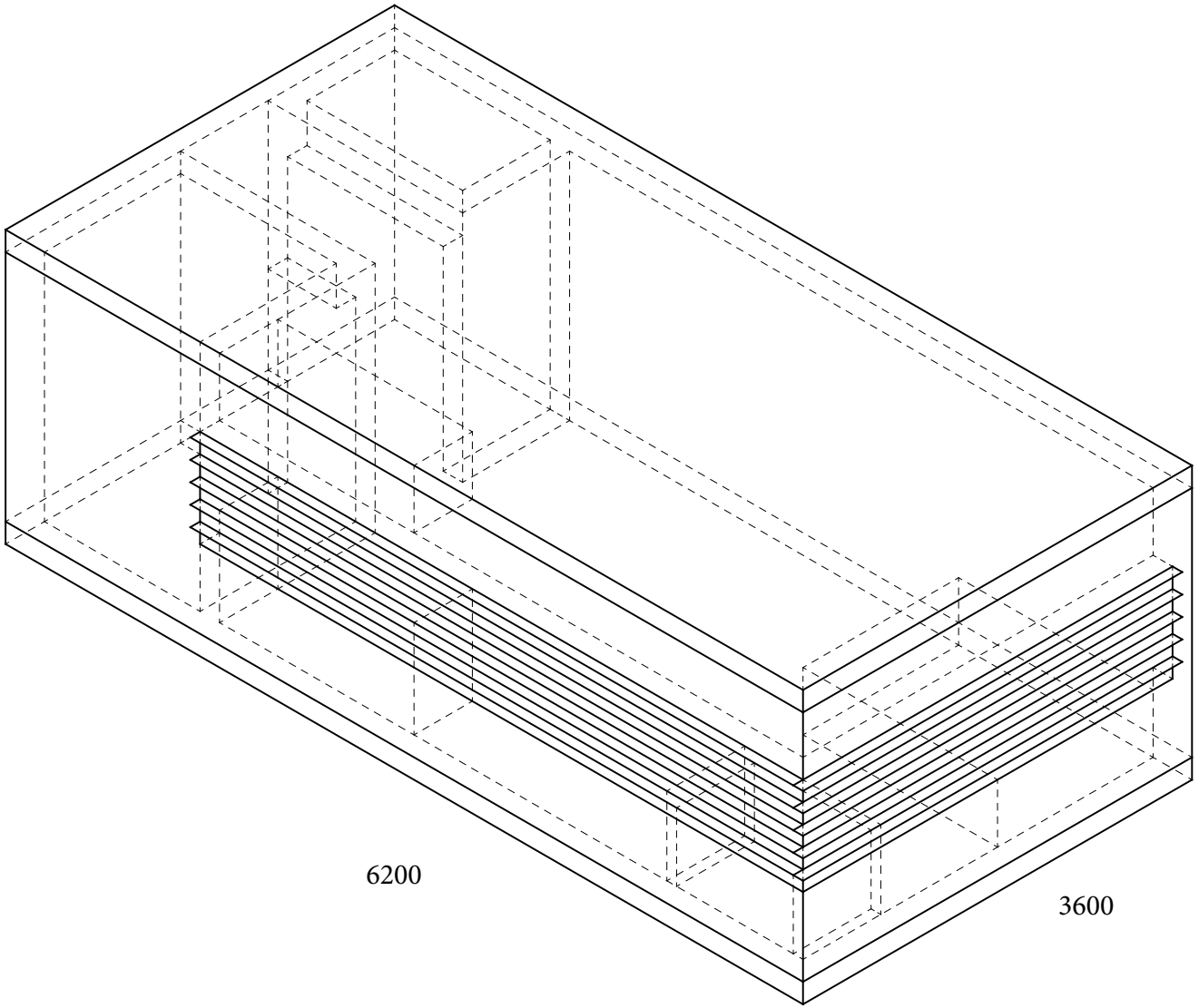


Daylighting Simulation
Target Surface Height: 2 feet

Overall process of the simulations were done in three steps. Firstly, base geometry was prepared and its construction materials were set with their typical R-Values. It was utilized for daylighting simulations and energy simulations. Especially, in terms of R-Value of the materials, it can be modified with the values of specific ASHRAE recommadation materials, and with custom numbers.

Secondly, for more accurate simulations, infiltration and natural ventilaion were applied. Also, using daylighting simulation, lighting schedules were applied for utilizing heating load from electric light as one of the simulation parameters.

Lastly, after completing each simulations, post processes were executed for visualizaion and extraction of important numbers

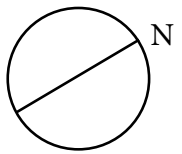


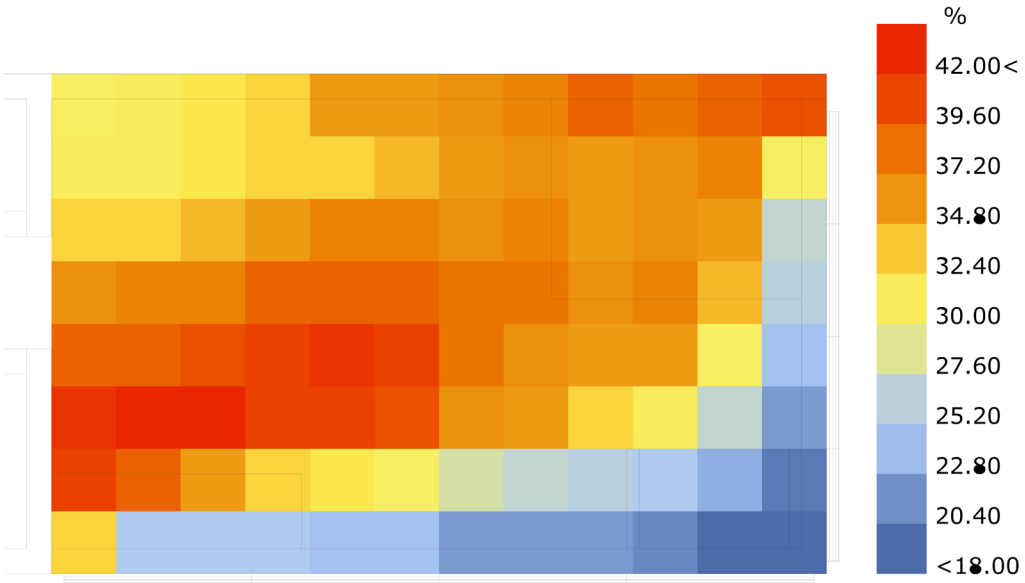
Shading Information

Depth: 0.1m
Number of Shadings: 5
Shadings Angle: 15

Material R-Value

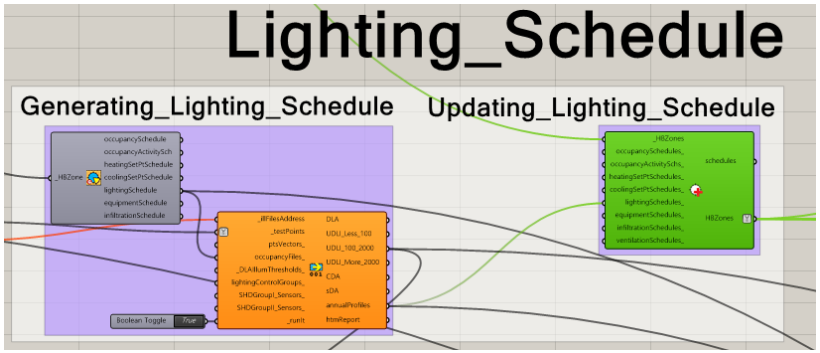
Wall: 3.522204
Window: 1.419566
Roof: 7.044407
Floor: 5.283306

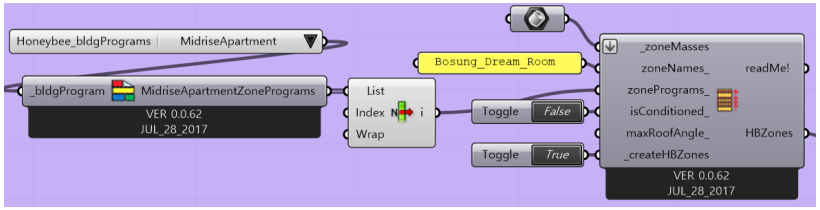




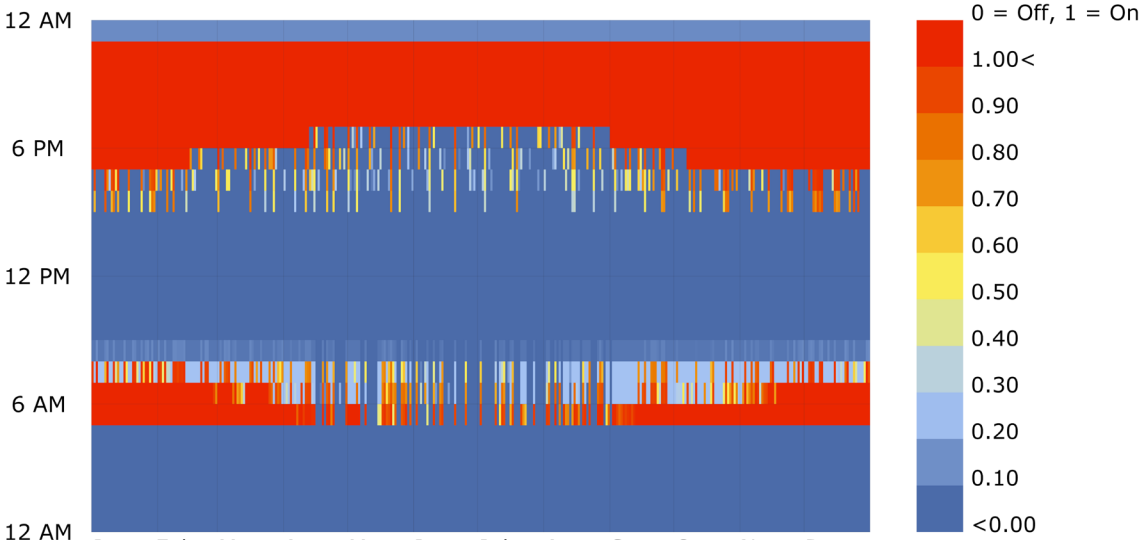
Daylight Autonomy
UDI 100 ~ 2000 lux

Average of the Whole Space: 32 %





Bilding Program Type: Midrise Apartment

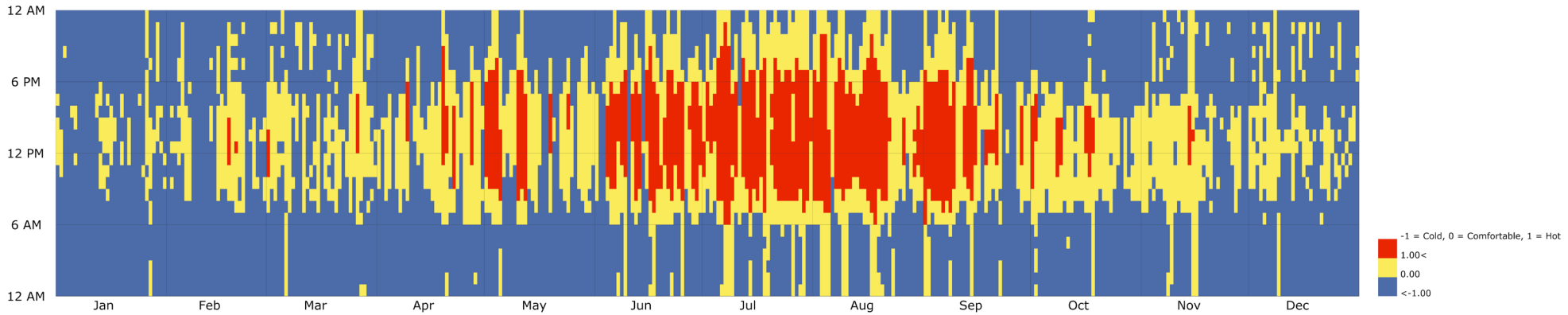


Lighting Switch Profile (0 = Off, 1 = On) - Hourly

1 JAN 1:00 - 31 DEC 24:00

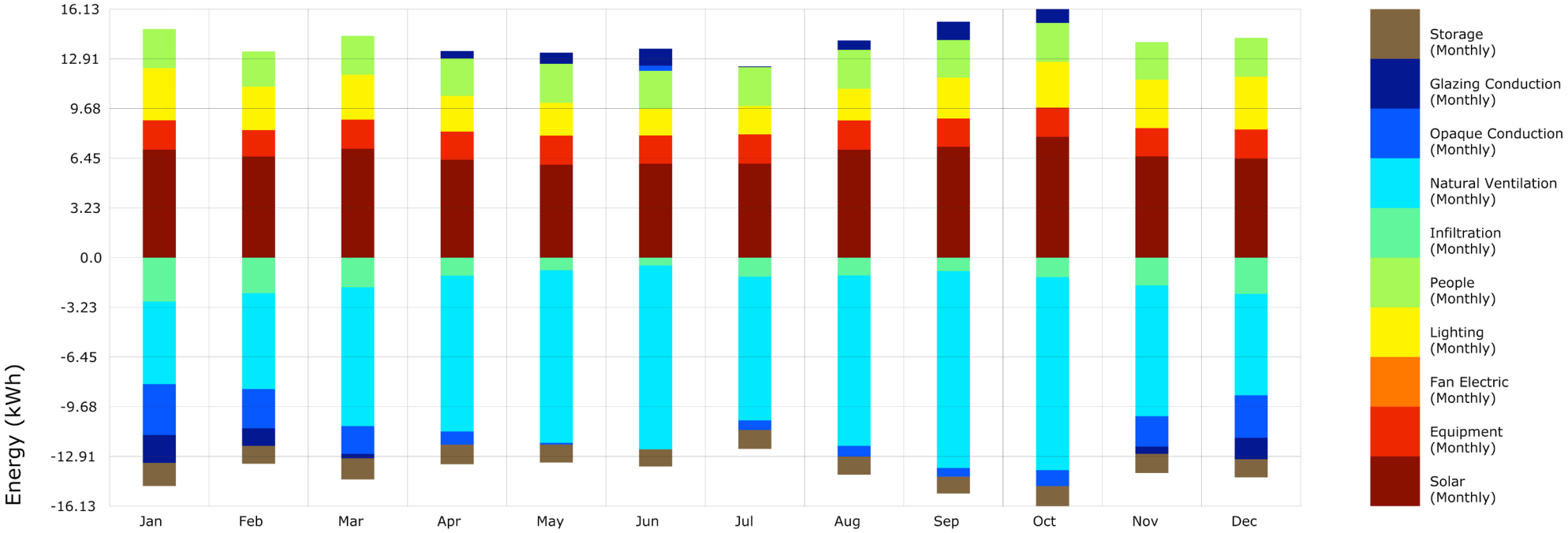
Lighting schedule was simulated with the result of daylighting simulation. Also, for more accurate siulation, I designated the type of building program; Midrise Apartment.

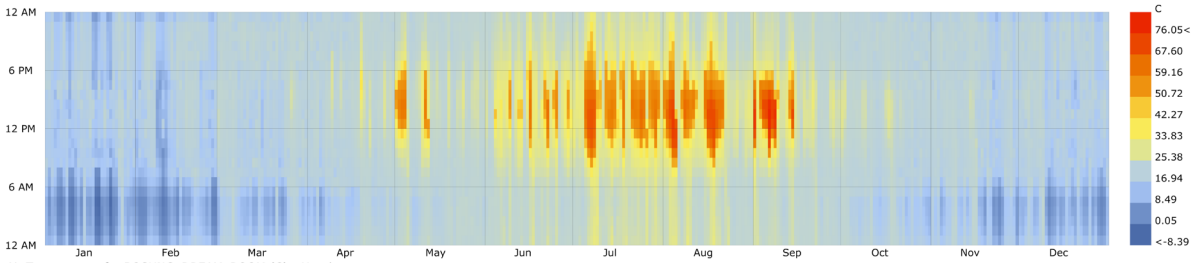
Mostly, heating load from electric light is loaded during the night time, so it could be useful for thermal comfort both of in summer and wintime.



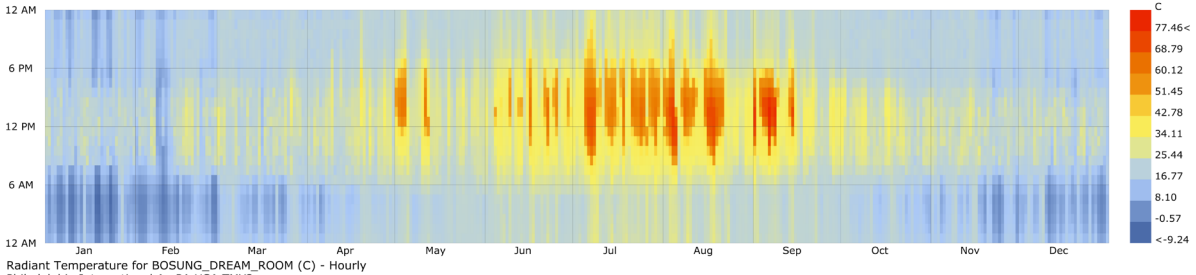
Adaptive Comfort for BOSUNG_DREAM_ROOM (-1 = Cold, 0 = Comfortable, 1 = Hot) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

Annual Total Comfortable Time: 29 %
Percent of Hot: 11 %
Percent of Cold: 60 %

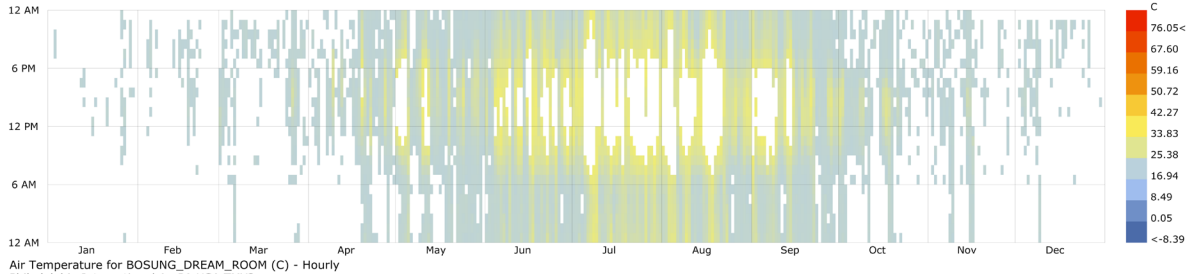




Air Temperature for BOSUNG_DREAM_ROOM (C) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00



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



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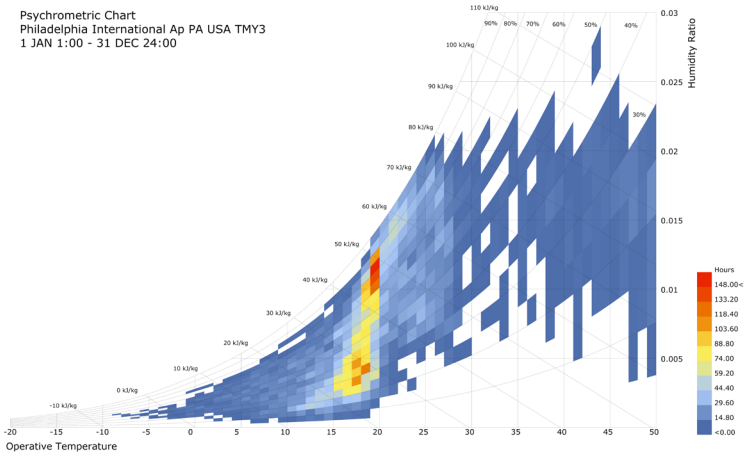
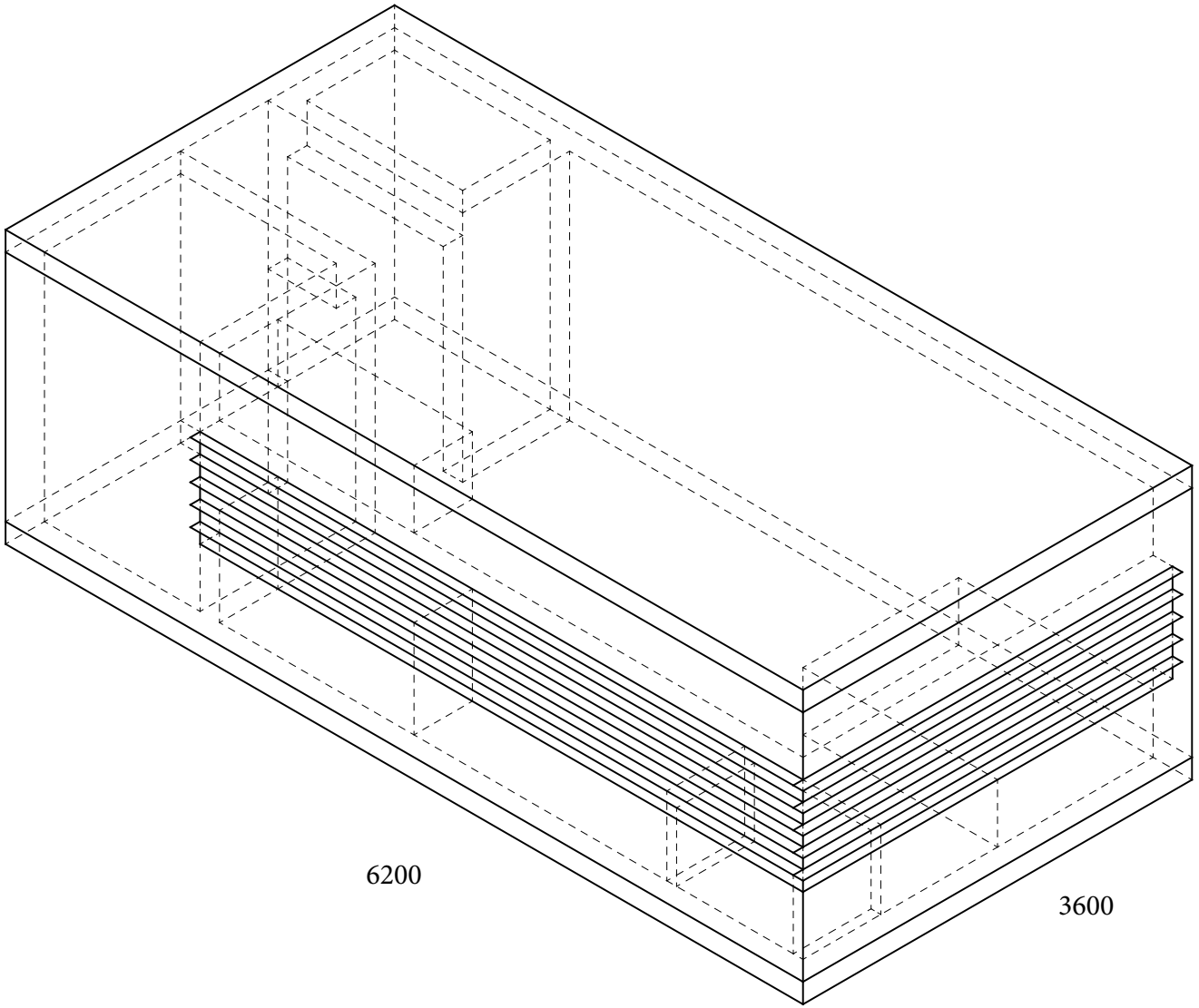


Percentage of Temperature between 18 and 28: 48%

In this case, during a year, the times satisfying the target temperature is almost half. Yet, the in the rest of the time, temparture changes much from very low one to very high one.

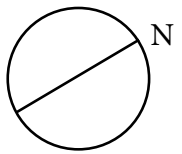


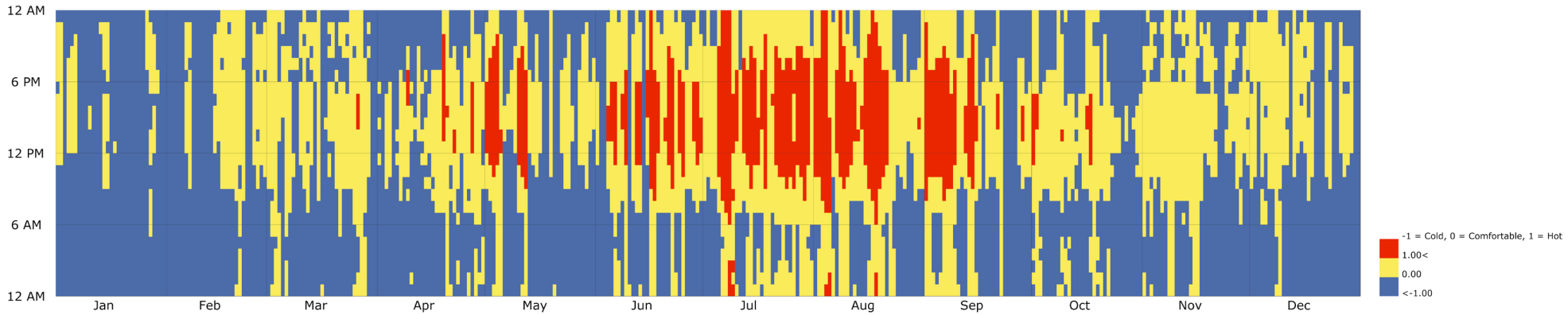
Shading Information

Depth: 0.1m
Number of Shadings: 5
Shadings Angle: 15

Material R-Value

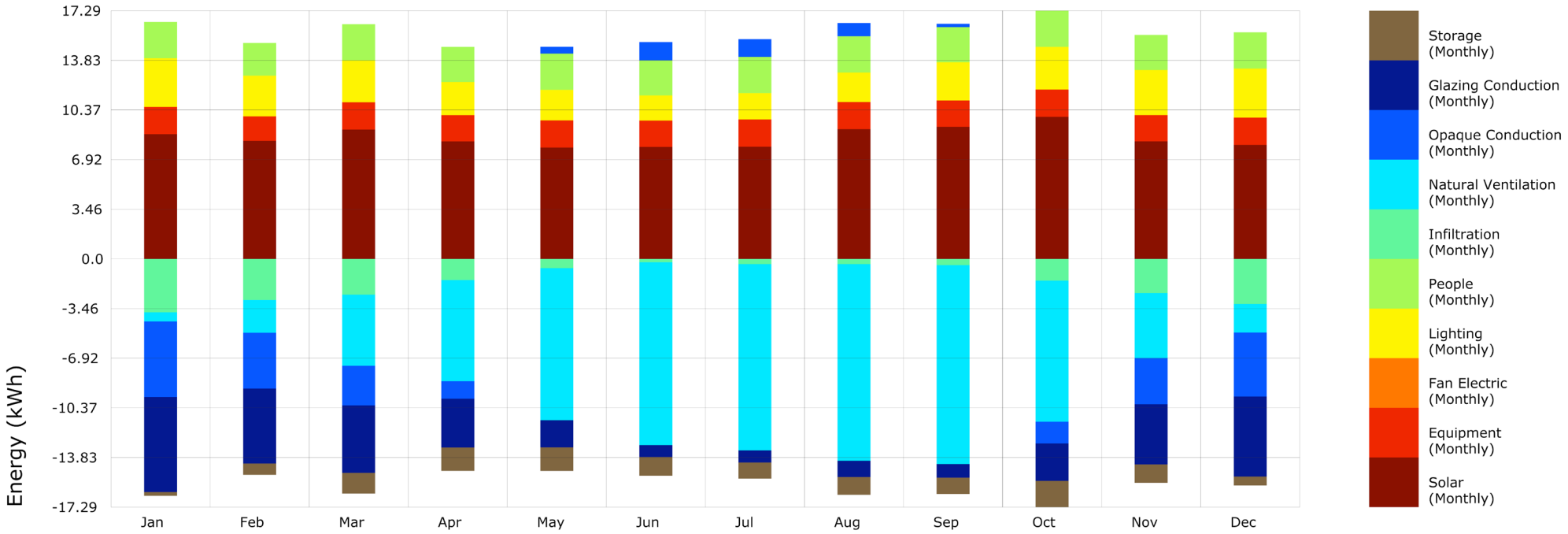
Wall: 2.602028
Window: 0.440275
Roof: 3.531596
Floor: 6.334161

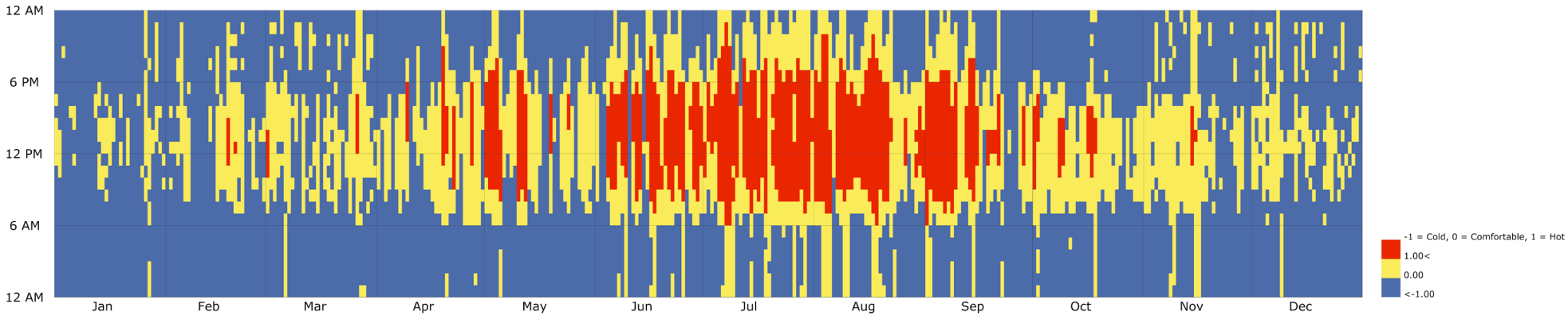




Adaptive Comfort for BOSUNG_DREAM_ROOM (-1 = Cold, 0 = Comfortable, 1 = Hot) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

Annual Total Comfortable Time: 39 %
Percent of Hot: 9 %
Percent of Cold: 52 %





Adaptive Comfort for BOSUNG_DREAM_ROOM (-1 = Cold, 0 = Comfortable, 1 = Hot) - Hourly
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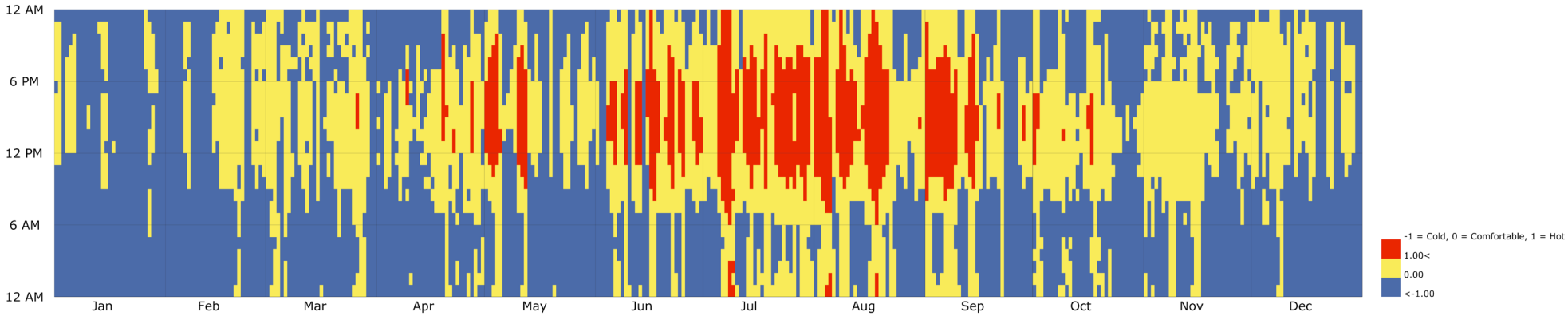

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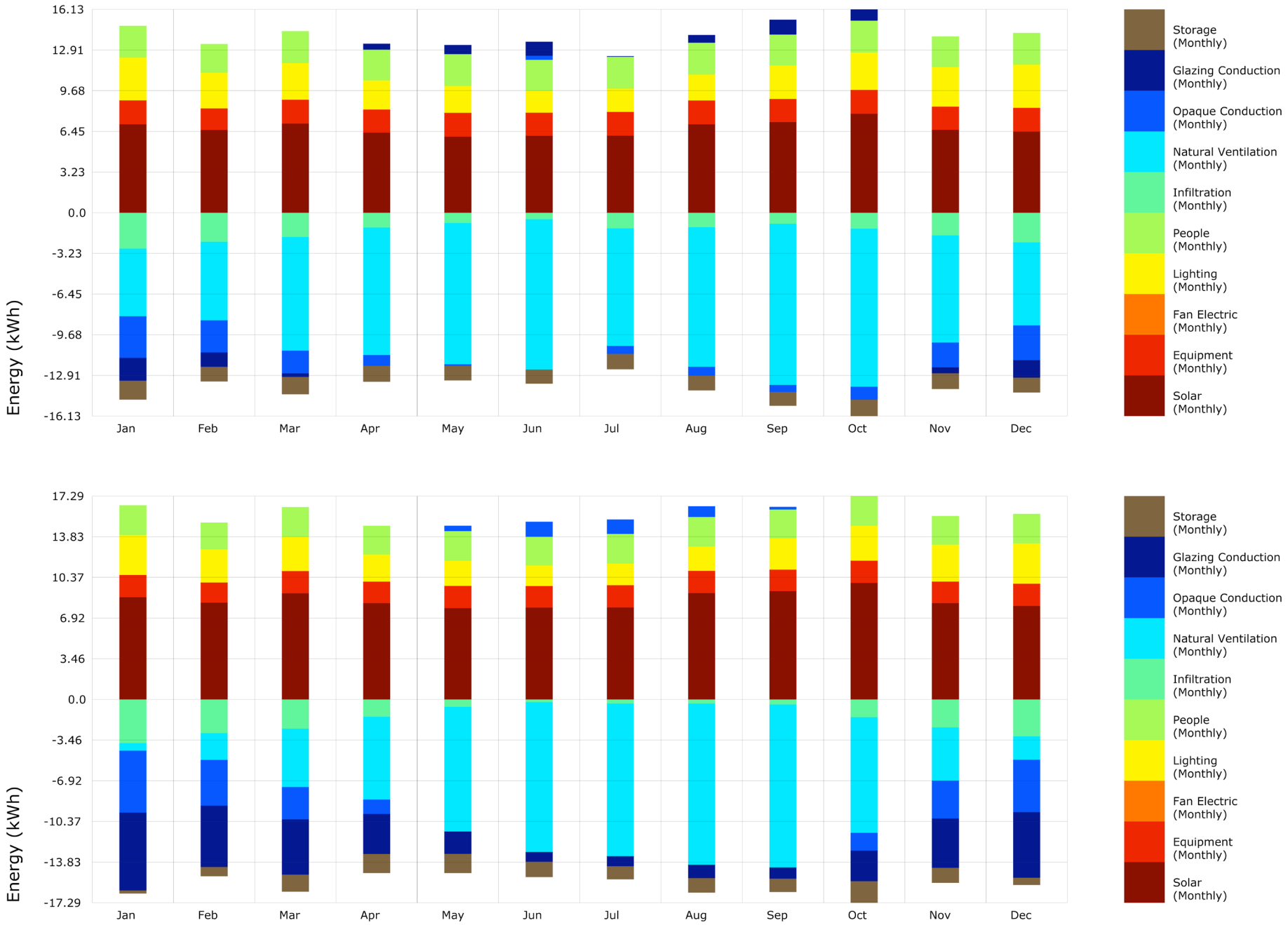
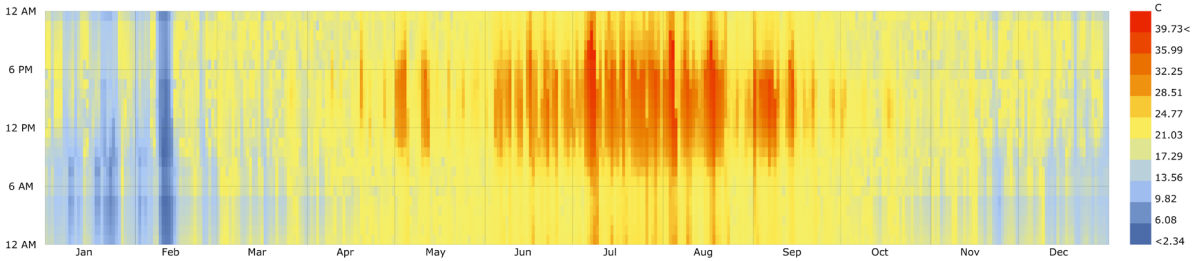
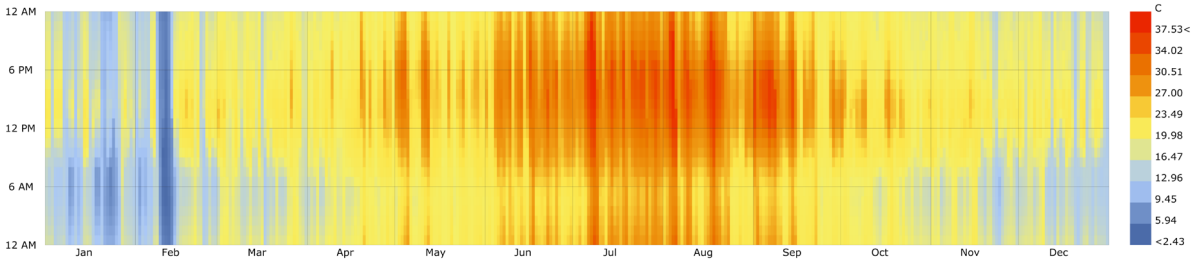


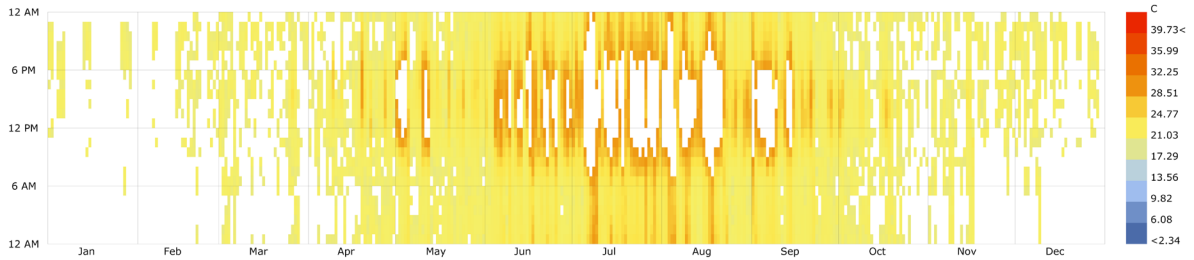
In summer overall energy gain from glazing conduction decreased, and in winter energy loss from natural ventilaion also decreased. However, energy loss from glazing conduction in winter increased simultaneously, which should be considered later simulations.



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

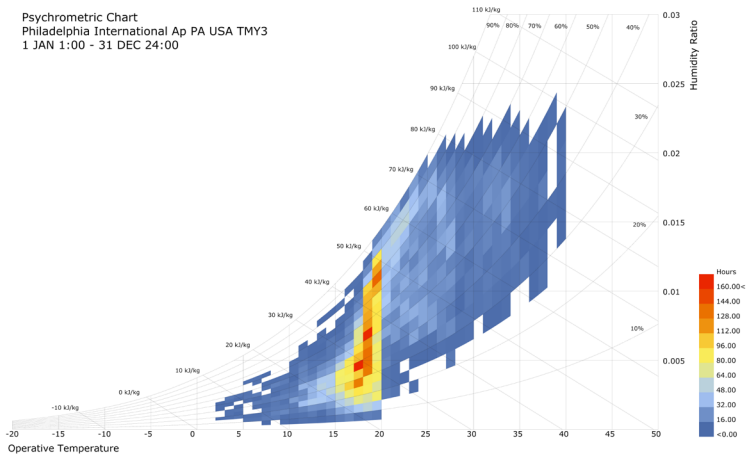


Radiant Temperature for BOSUNG_DREAM_ROOM (C) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

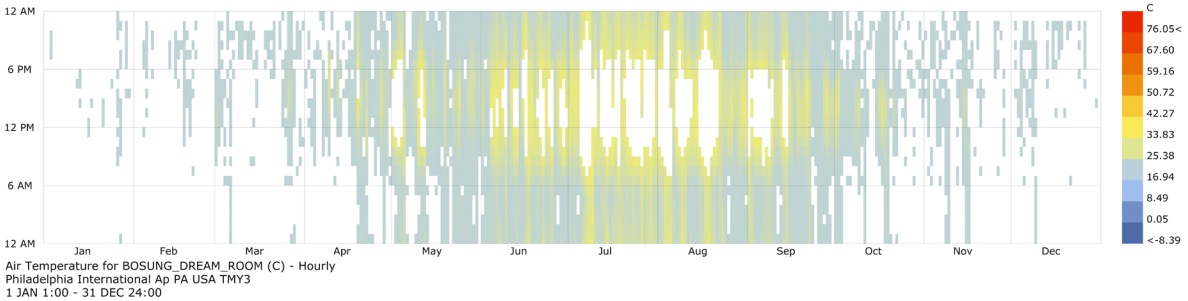


Air Temperature for BOSUNG_DREAM_ROOM (C) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

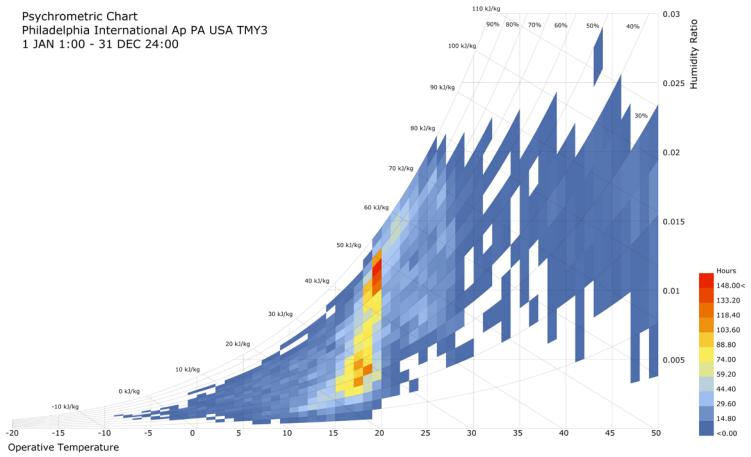
Psychrometric Chart
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

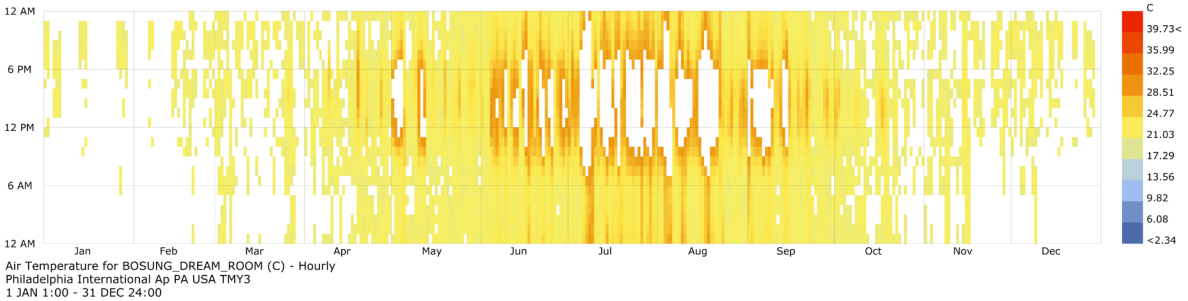


Percentage of Temperature between 18 and 28: 58%

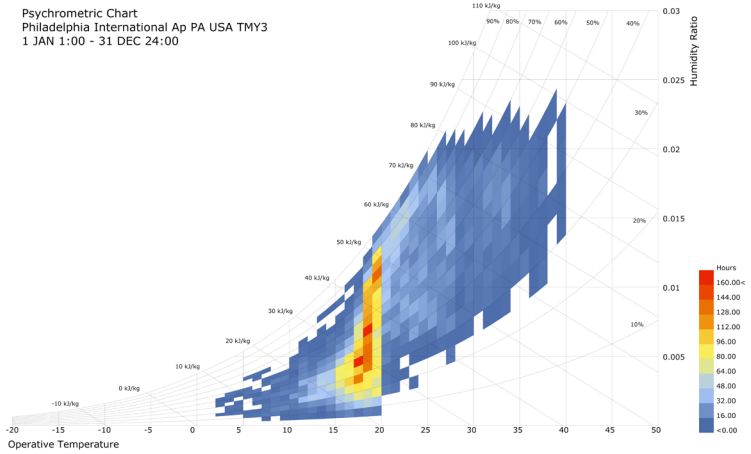


Percentage of Temperature between 18 and 28: 48%

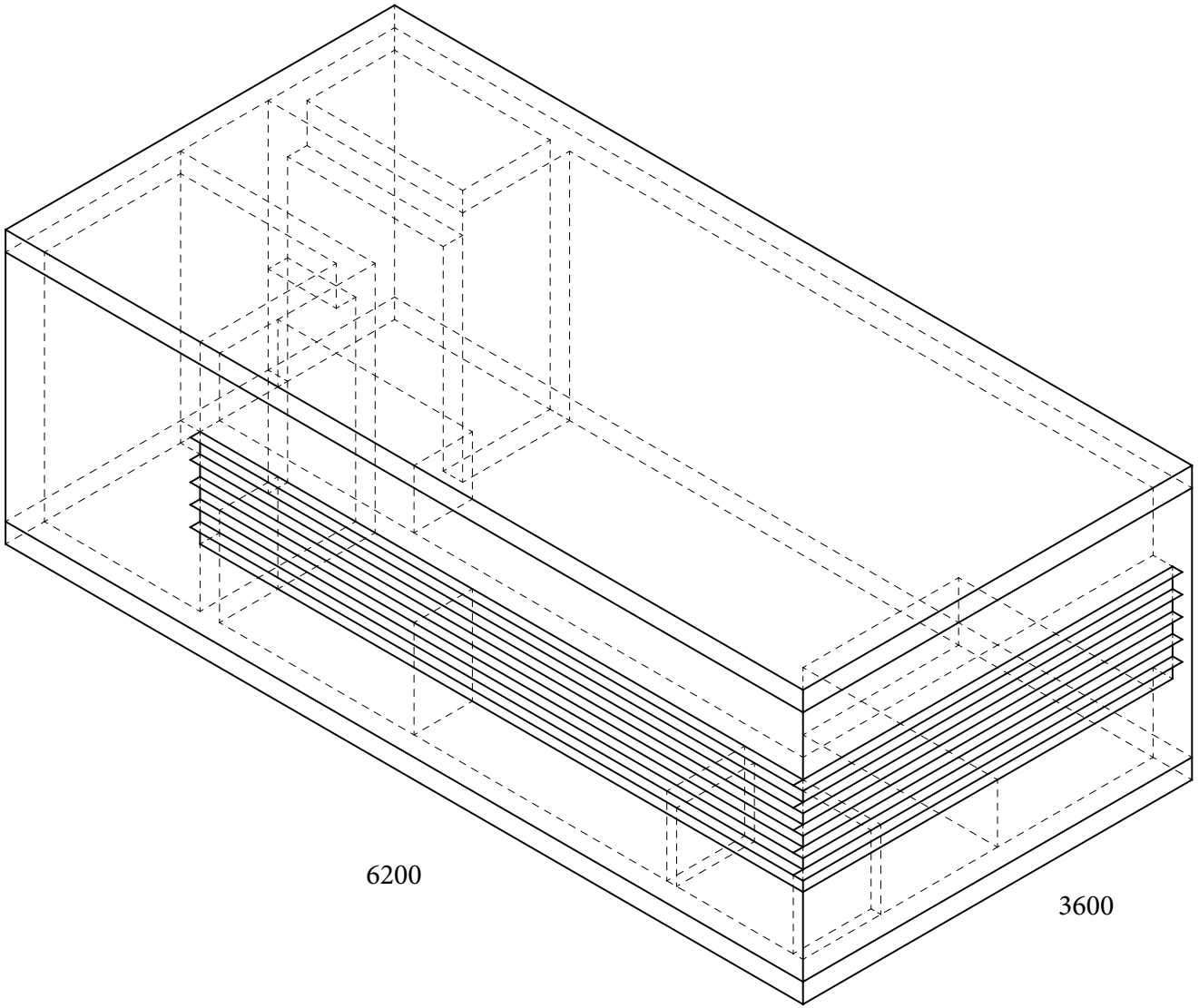




Percentage of Temperature between 18 and 28: 58%



In this case, during a year, the times satisfying the target temperature increased by 10%. Also, the range of times in psychometric chart shrank, while more times were located at the prefer comfort zone.

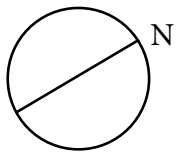


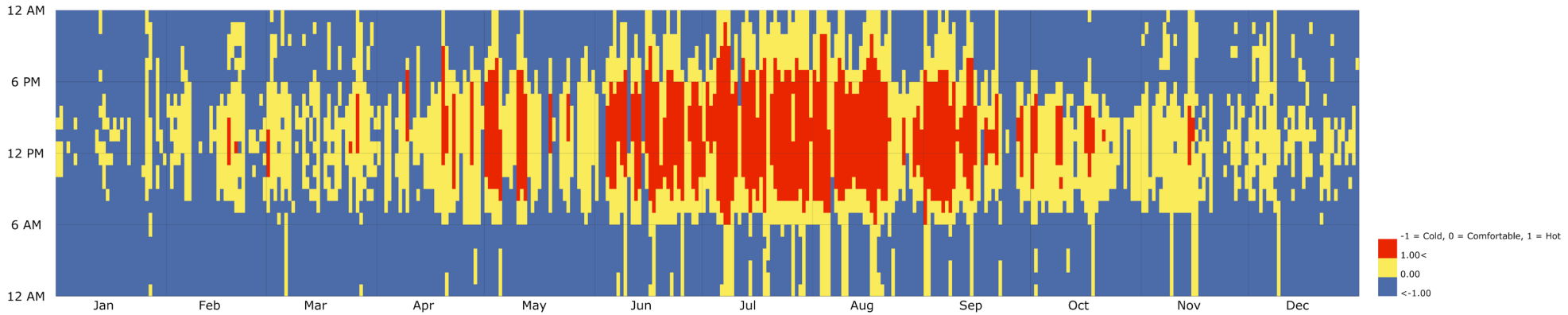
Shading Information

Depth: 0.1m
Number of Shadings: 5
Shadings Angle: 15

Material R-Value

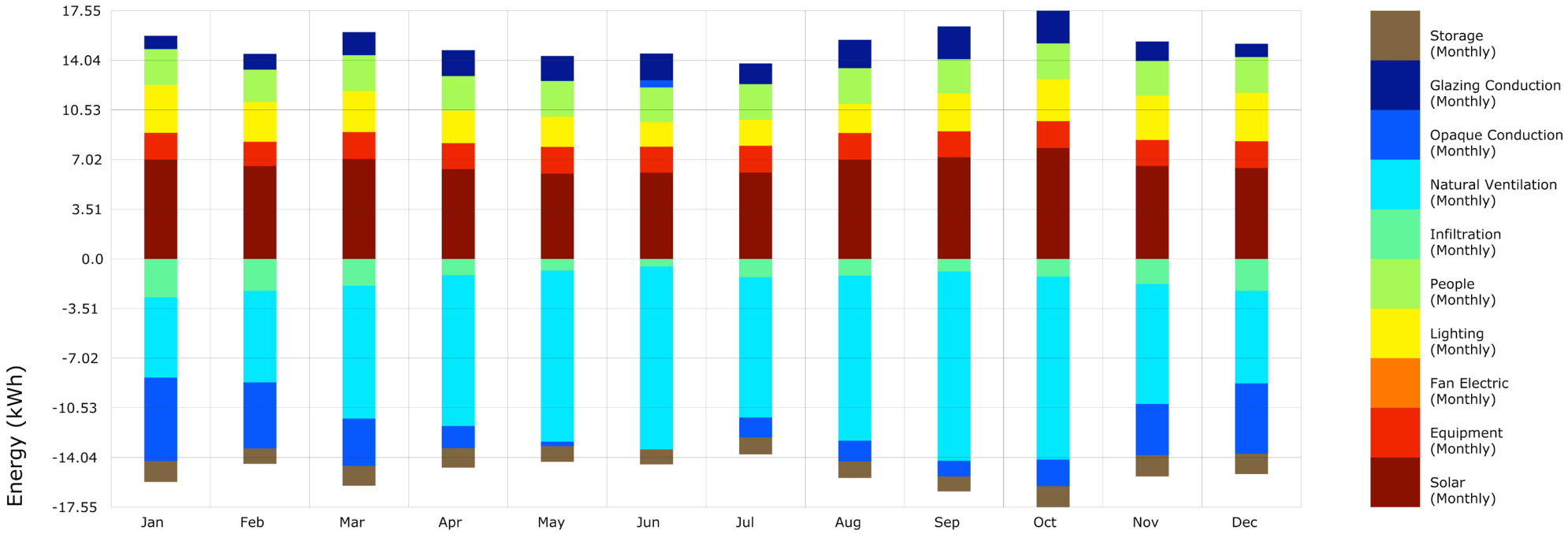
Wall: 1.761102
Window: 0.567826
Roof: 3.522204
Floor: 2.641653

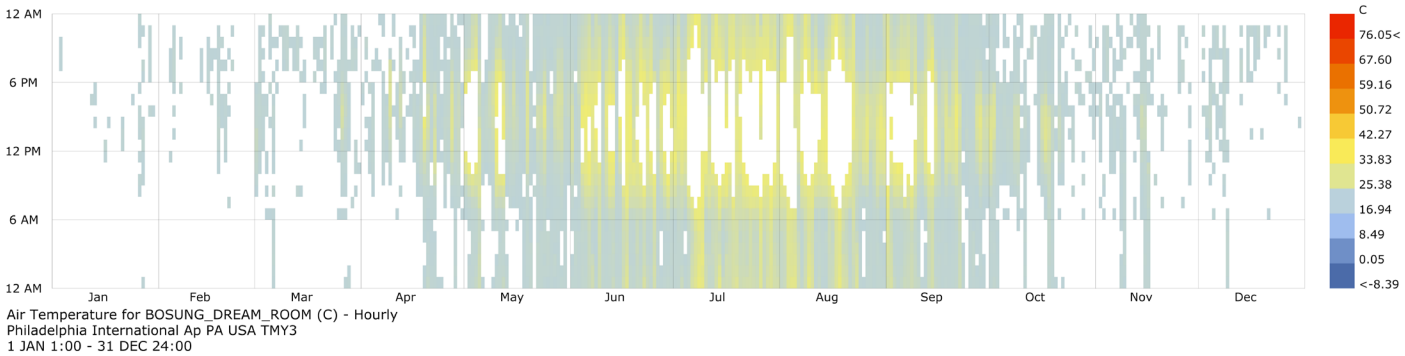




Adaptive Comfort for BOSUNG_DREAM_ROOM (-1 = Cold, 0 = Comfortable, 1 = Hot) - Hourly
Philadelphia International Ap PA USA TMY3
1 JAN 1:00 - 31 DEC 24:00

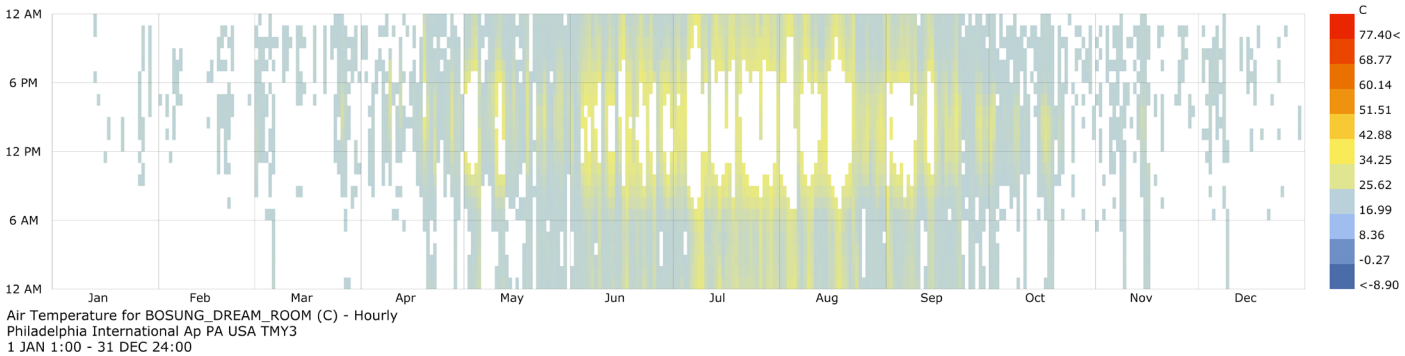
Annual Total Comfortable Time: 29 %
Percent of Hot: 12 %
Percent of Cold: 60 %





Percentage of Temperature between 18 and 28: 48%

Percentage of Temperature between 18 and 28: 58%



Percentage of Temperature between 18 and 28: 47%

In the two simulations, I lower the R-values of the construction materials, and made better thermal comfort. Thus, in the third experiment, I lowered them more, yet, this time, not only thermal comfort and inddor temperature became worse. In particular, indoor emperature become similar to the case of high R-Value.

By this series of simulations, I got a conclusion that there is a optimal point of the material R-Values for the room of a certain condition.

Next time, I will fix the material properties and change the geometry of shadings and exmaine the results of energy simulations.