

ENERGY SIMULATION

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Arch 753 Building Performance Simulation
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INITIAL SIMULATION

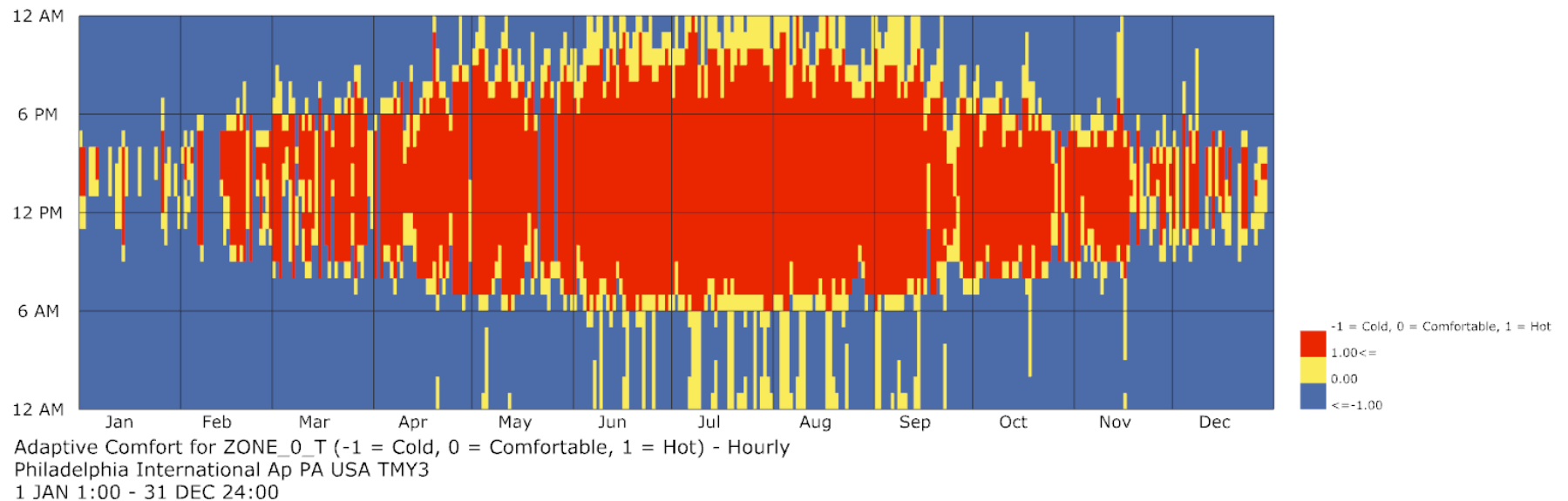
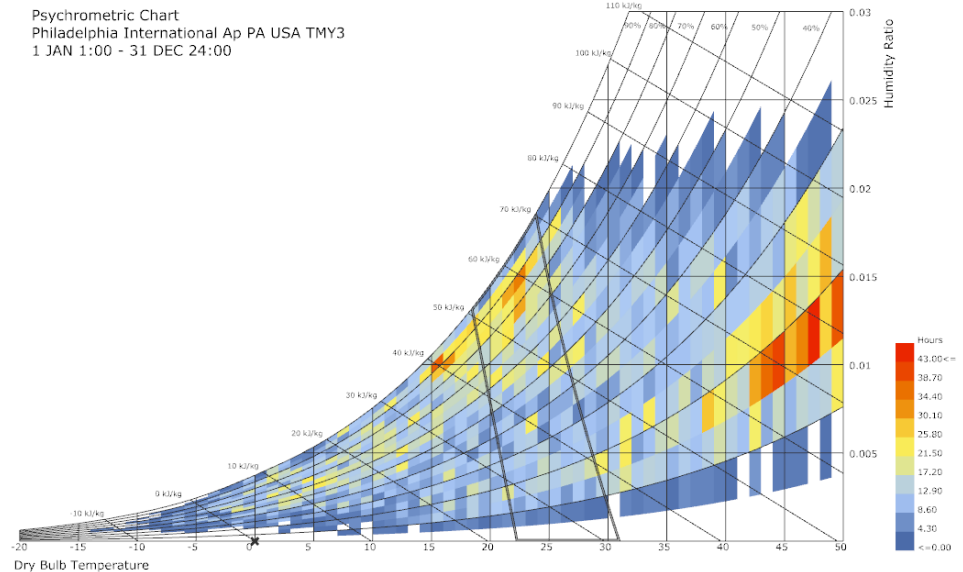
COMFORT(%): 12.82

HOT(%): 33.88

COLD(%): 53.3

The initial data shows that the comfort hours is only 12.82% and most of which comes from the winter because people feel more cold than hot. So my proposal will be:

- (1) Make the north window smaller to prevent cold air.
- (2) Change the orientation to the light.
- (3) Use as thick construction as possible to prevent heat leak.
- (4) Add Blinds to decrease the hot hours.



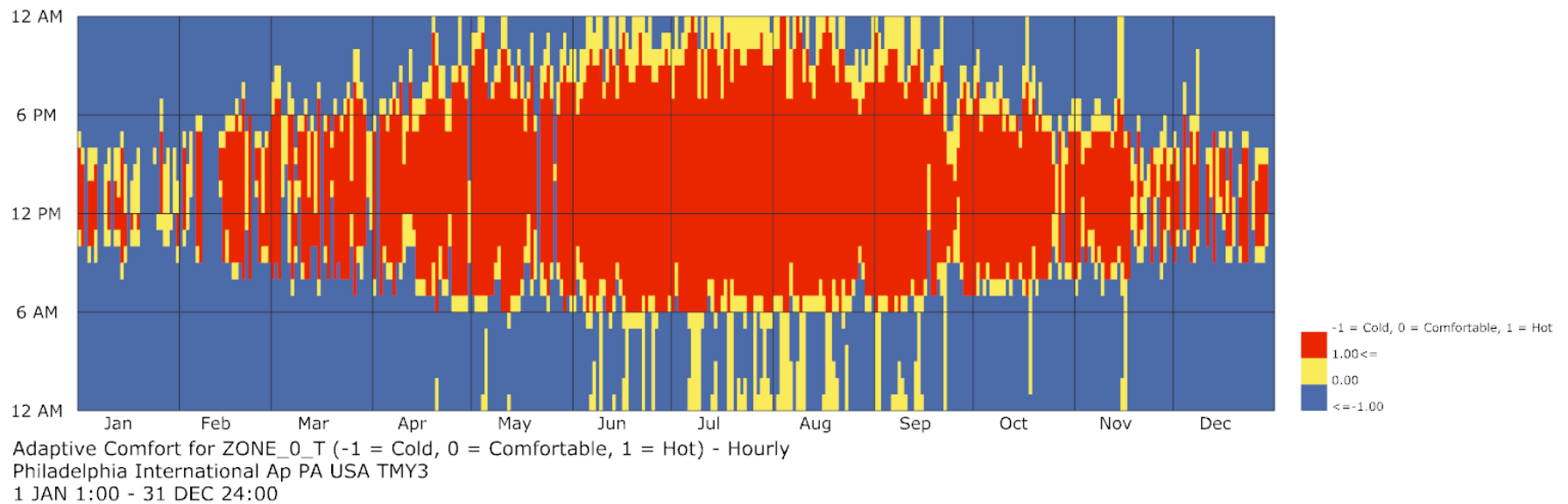
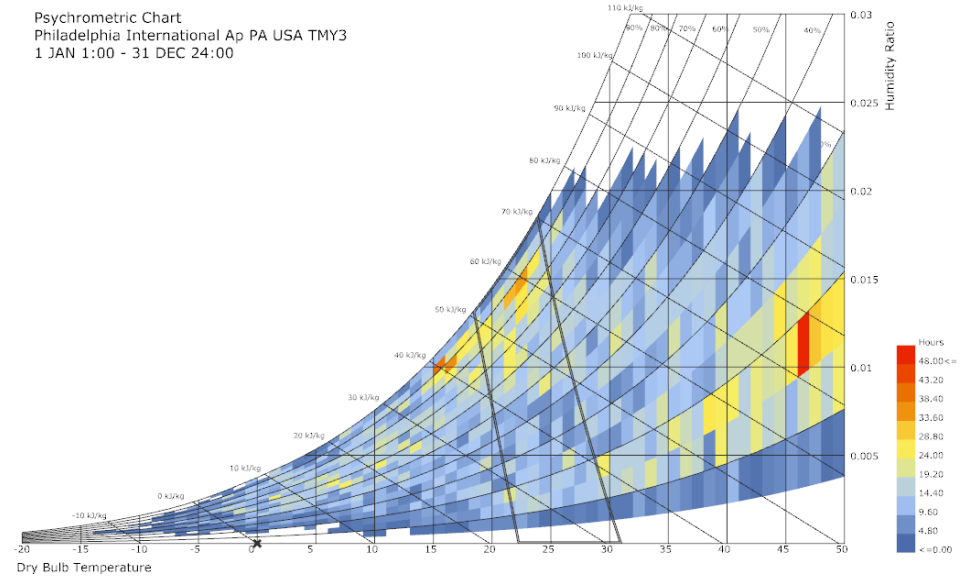
CHANGE WINDOW RATIO

COMFORT(%): 13.07

HOT(%): 36.27

COLD(%): 50.66

Firstly I changed the ratio by making the east and south side windows be bigger and north and west be smaller. The comfort percentage becomes more, however the hot hours also increase.



CHANGE WINDOW RATIO

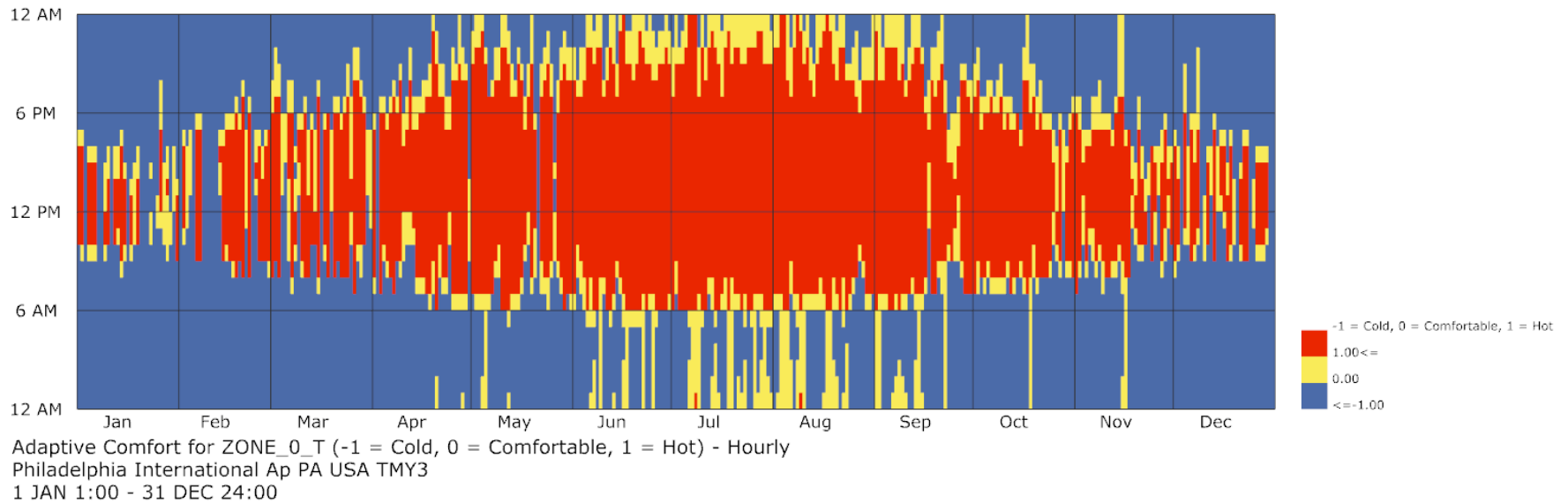
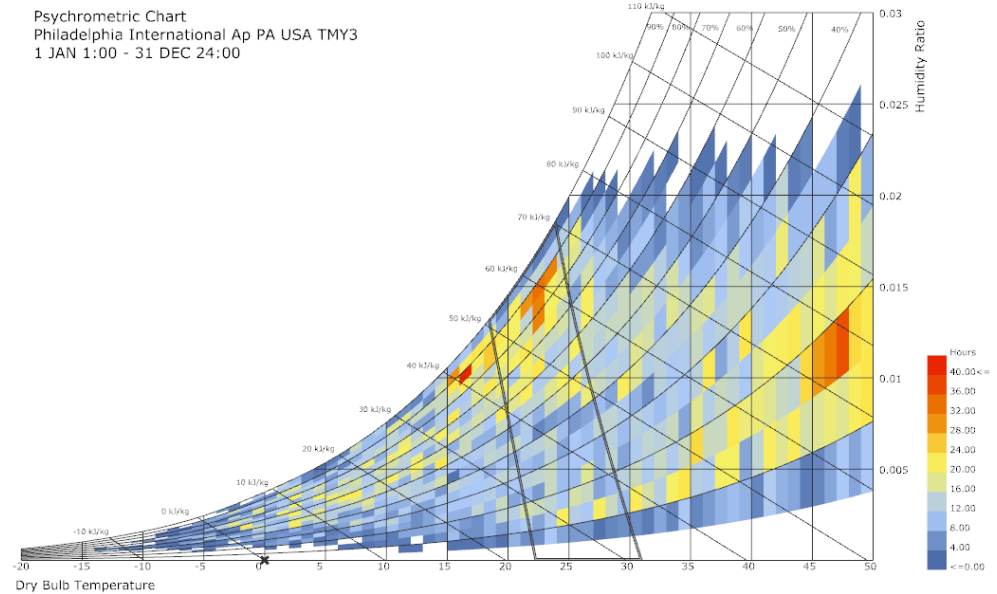
COMFORT(%): 13.18

HOT(%): 37.13

COLD(%): 49.68

Secondly I only changed the ratio by making the south side windows be bigger and north and west be smaller. The comfort percentage becomes more, however the hot hours also increase.

From the data we need to know that the big ratio brings not only warmer comfort but also makes it worse in summer. In reality, we have to close the window in the summer and use AC, and open it on sunny days in winter. From the diagram at right, the hot zone (a red T shape) is getting bigger. So opening windows can only bring comfort to people who can stand hot.



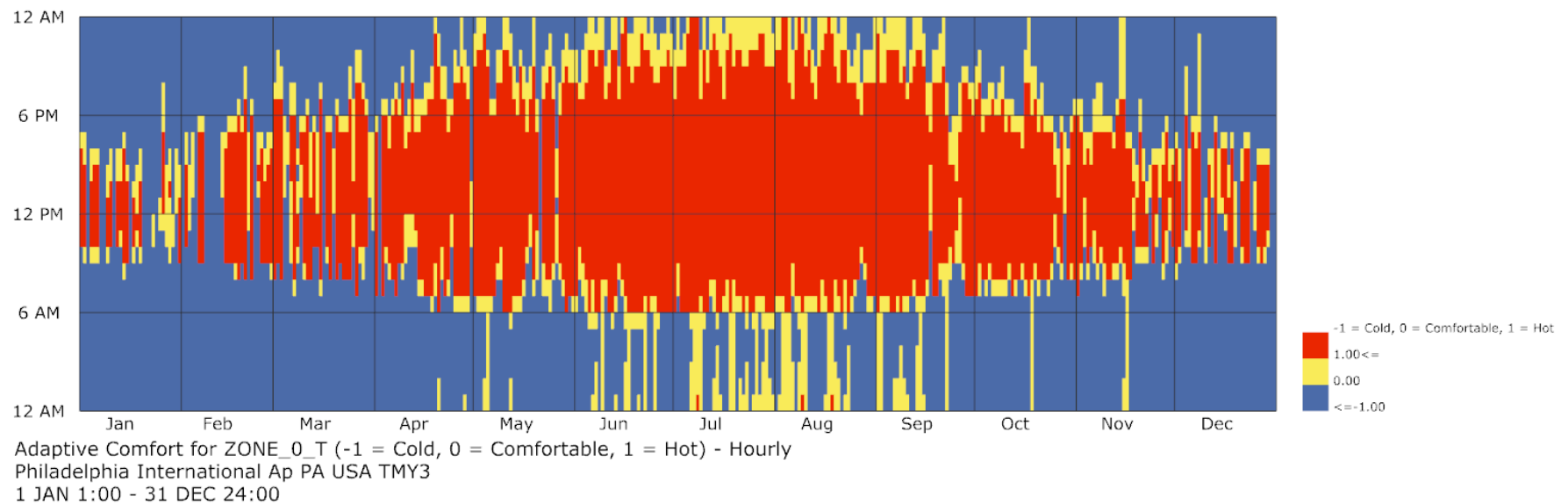
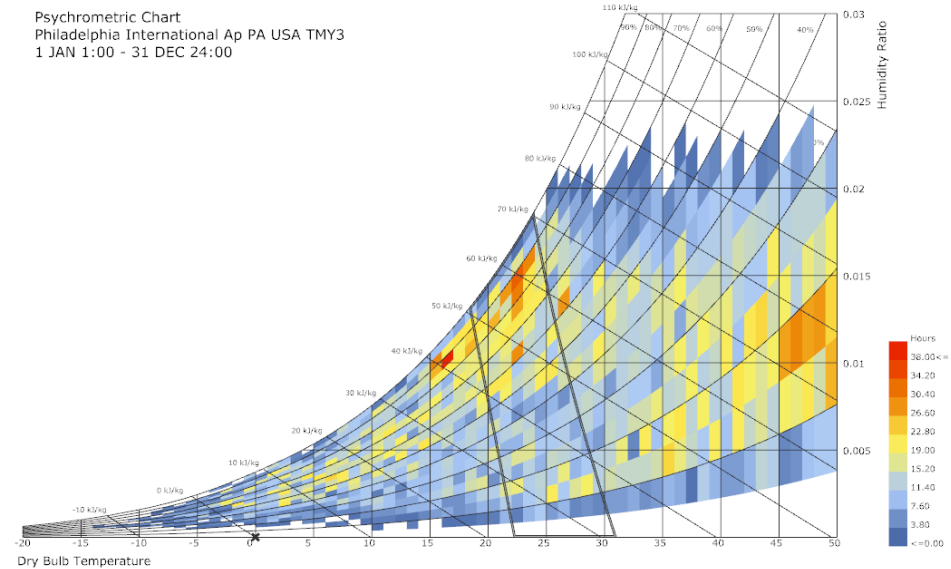
CHANGE WINDOW RATIO

COMFORT(%): 13.32

HOT(%): 37.23

COLD(%): 49.45

I keep changing but find that the comfort percentage starts to change very slowly.



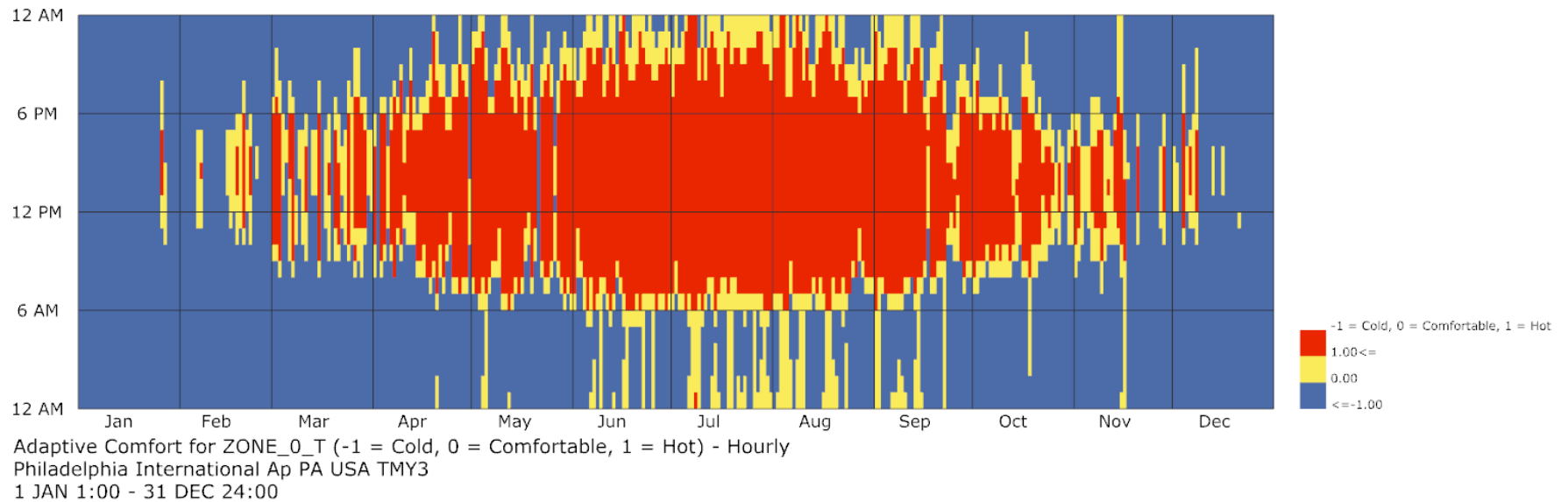
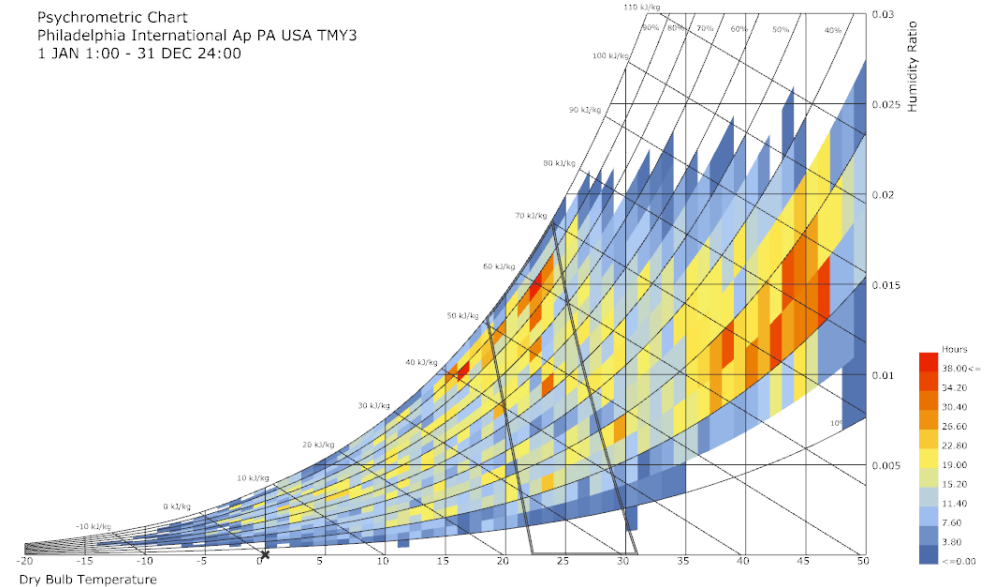
CHANGE WINDOW RATIO

COMFORT(%): 13.96

HOT(%): 29.44

COLD(%): 56.6

I keep changing but find that the comfort percentage starts to change very slowly.



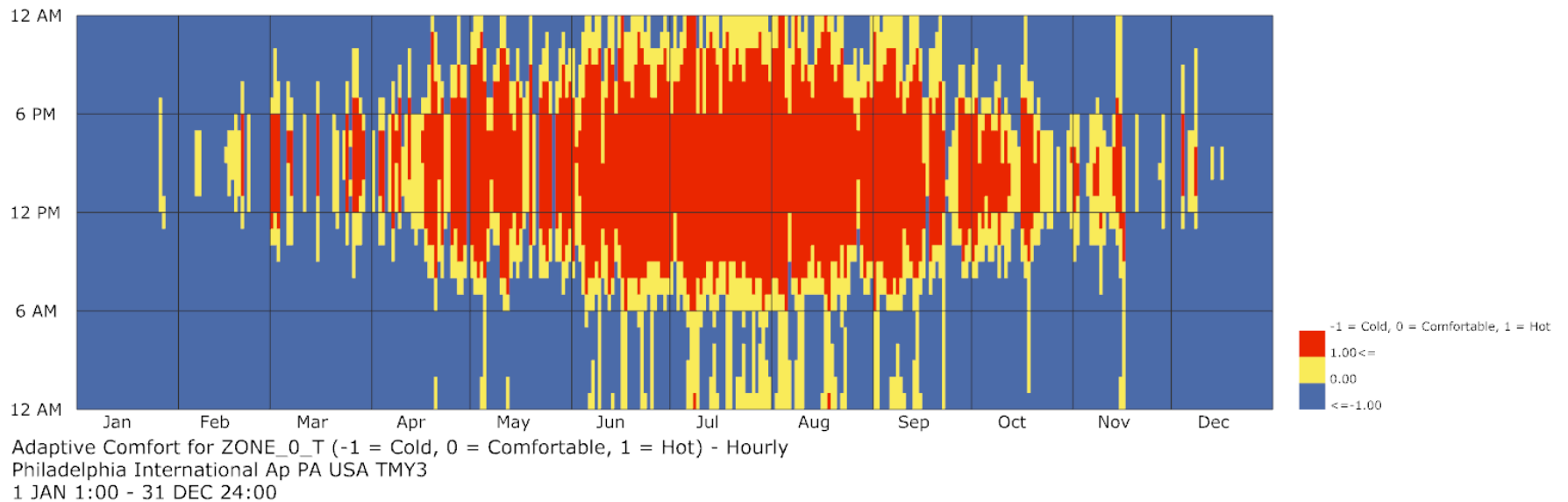
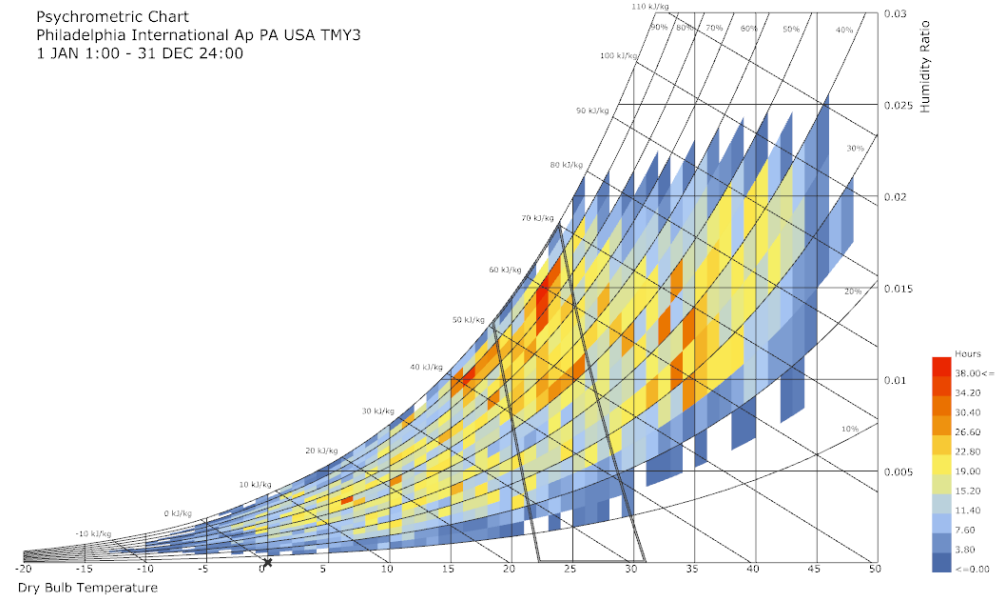
CHANGE ORIENTATION

COMFORT(%): 16.3

HOT(%): 22.73

COLD(%): 60.97

Changing orientation by rotating it clockwise 90 degrees can dramatically influence the comfort hours and percentages. However the wind will be also stronger since in this model I only give the south and east window. As we can see from the diagrams and datas, with the increase of the comfort percentage, the hot and cold percentages have also increased comparing with 0 degree rotated.



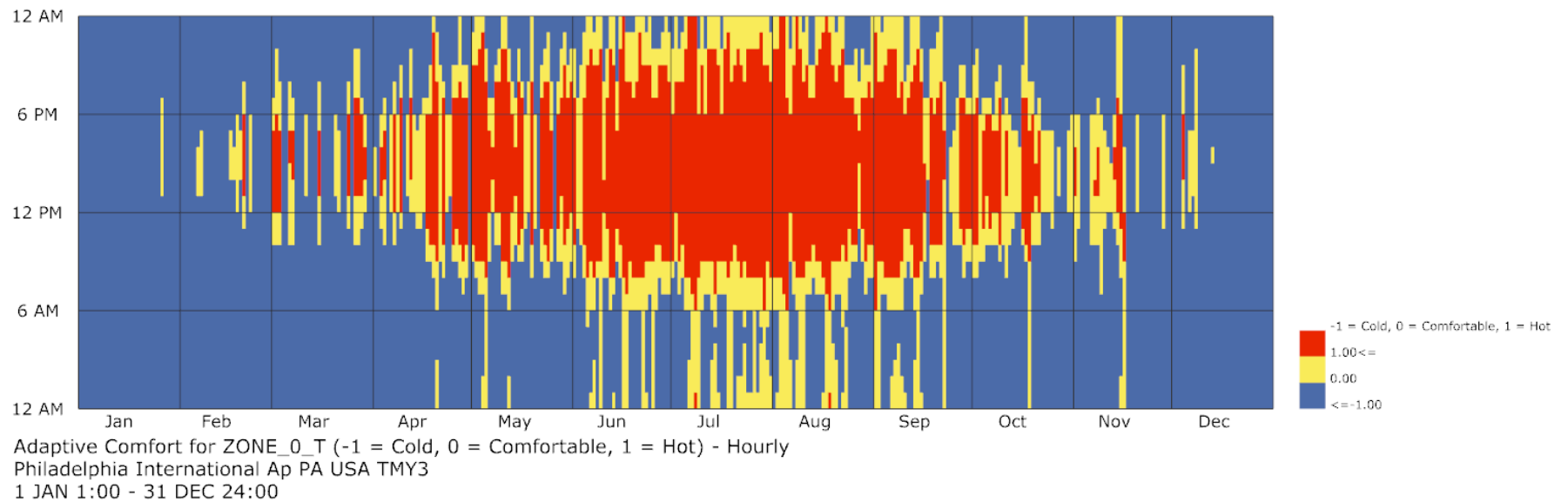
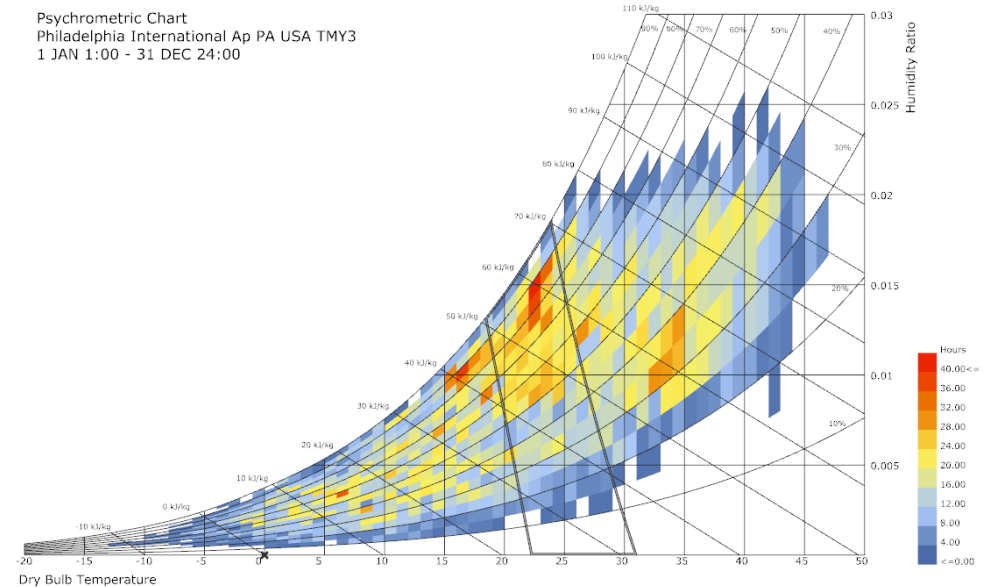
ADD BLINDS

COMFORT(%): 16.72

HOT(%): 21.2

COLD(%): 62.08

Adding blinds is effective for decreasing the hot hours. However, the cold hours have been increased since the blinds can block the sunshine. For the model, the blinds' data is not dynamic, means as long as I choose the "true" the blinds will be always added. In the real life we can add blinds only at when it is needed.



ADD BLINDS

COMFORT(%): 20.76

HOT(%): 19

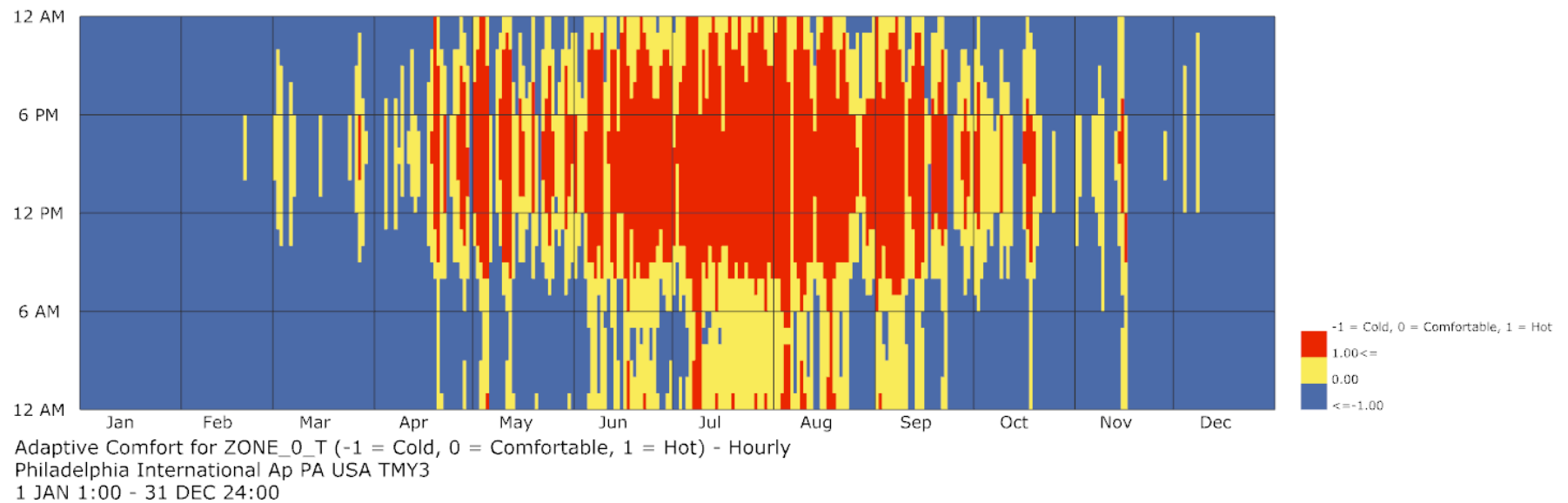
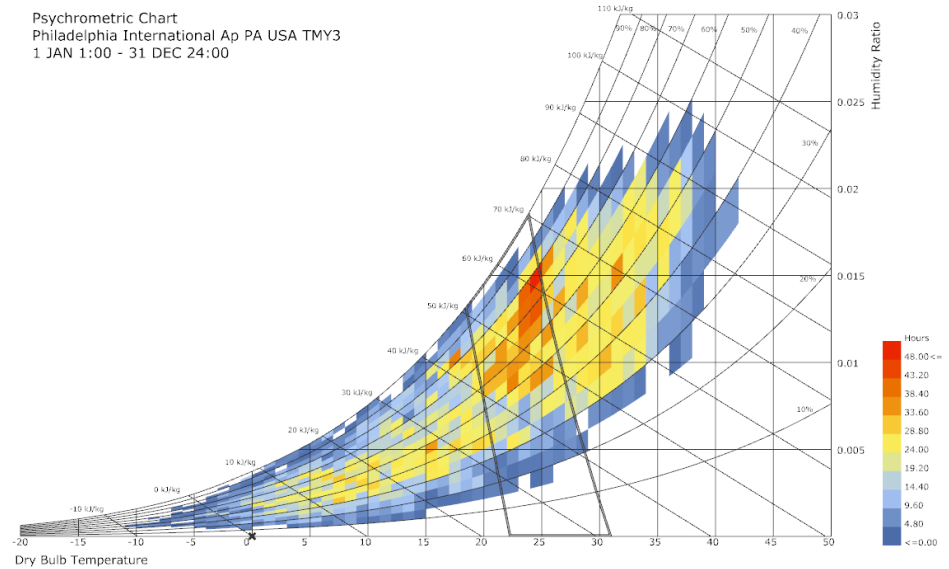
COLD(%): 60.24

EXTERIOR WALL: R34.4

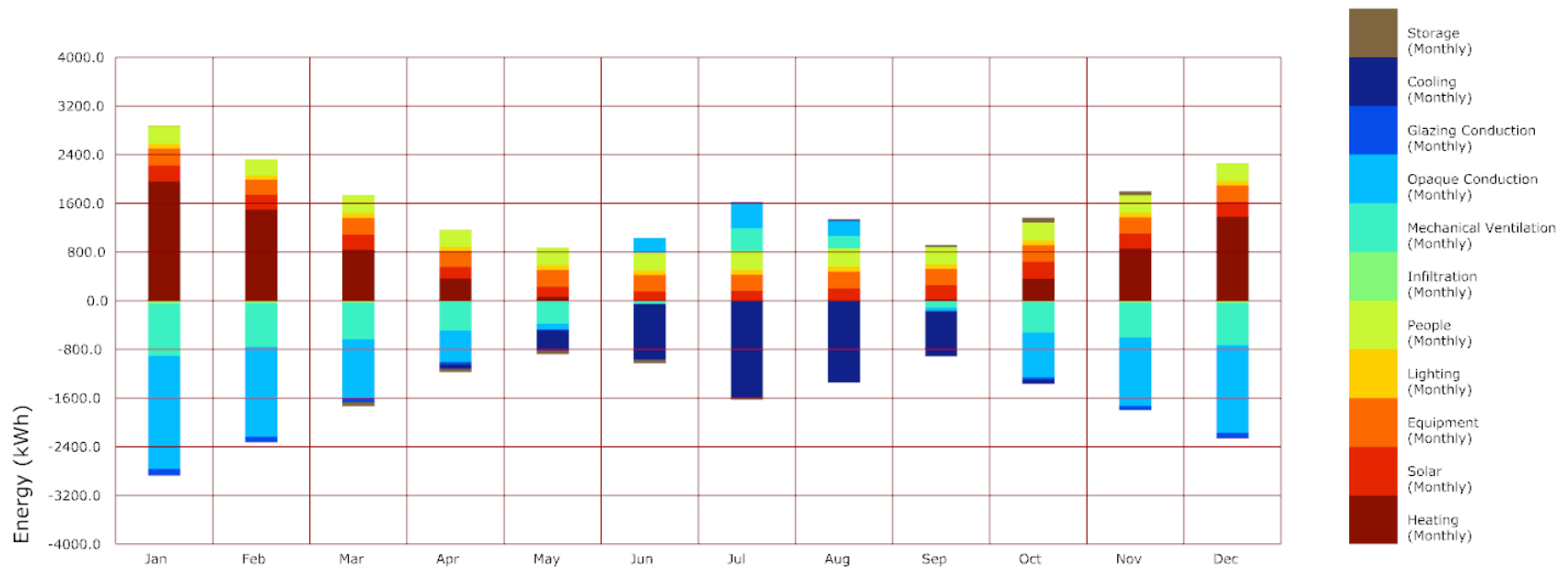
EXTERIOR WINDOW: R1.9, SHGC 0.39

EXTERIOR ROOF: R34.4

I chose the highest resistance value to block the heat out in the summer and remain the heat inside in winter. Both the hot hours and cold hours decreased.



COMFORTABLE/UNCOMFORTABLE HOUR SOURCE IDENTIFICATION



Jieming Test Room Energy Balance

From the chart above we can learn that from October to March, the energy consumption is higher. This is because that during winter we need more energy for the heater than we need for air conditioner. The main three parts are Opaque Conduction, Heating and Mechanical Ventilation. From the comfort hours' data before, we know that in my house the cold condition is worse than hot. The main factor for the cold hour(uncomfortable hour) is from the wind and cold temperature outside in Philly. If I want to create a more comfortable condition, I firstly will start to prevent heat lose in winter.